

# PROCEEDINGS

OF THE

## GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

## ZOOLOGICAL SOCIETY OF LONDON.

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January 5, 1892.

Professor Newton, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the months of November and December 1891:—

The total number of registered additions to the Society's Menagerie during the month of November was 45, of which 20 were by presentation, 1 by birth, 15 by purchase, and 9 on deposit. The total number of departures during the same period, by death and removals, was 91.

Amongst these attention may be called to the four Spotted-billed Pelicans (*Pelecanus manillensis*), received from Calcutta. This species, which is new to us, is a close ally of the African *P. rufescens*. When the birds come into full plumage we shall be able to see how far they differ from their African relative.

The registered additions to the Society's Menagerie during the month of December 1891 were 82 in number. Of these 71 were acquired by presentation, 8 by purchase, and 3 by exchange. The total number of departures during the same period, by death and removals, was 74.

Amongst these special attention may be called to the second specimen we have received of the Formosan Fruit-Bat (*Pteropus morsus*), of which the original specimen was received in January, 1873 (see P. Z. S. 1873, p. 192, pl. xxii.<sup>1</sup>). The present example

<sup>1</sup> This specimen died Oct. 4, 1879, and was acquired by the British Museum.  
—P. L. S.

was presented to the Society by Thomas Perkins, Esq., F.Z.S., Dec. 1st, 1891.

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Dr. E. C. Stirling, C.M.Z.S., exhibited some specimens of the new Australian Marsupial (*Notoryctes typhlops*), and gave a short account of the habits of this remarkable animal, as observed in a specimen recently kept in captivity by one of his correspondents.

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The following extract was read from a letter received by the Secretary from Dr. F. A. Jentink, F.M.Z.S., dated Leyden, 4th December, 1891:—

“In a paper published September 1890 (Notes from the Leyden Museum, p. 222) I called the attention of naturalists to the remarkable Bush-rat, *Pithechir melanurus*, from Java and Sumatra. The type of this black-tailed red Rat is a drawing in colours, by Duvaucel, reproduced in Cuvier’s ‘Mammifères.’ No specimen of the *Pithechir melanurus* is in the Paris Museum, nor has it ever been observed by a naturalist, except by the late Dr. S. Müller, who procured in 1834 two skins from Padang and Batavia for the Leyden Museum, where they are still preserved. I think it will highly interest the members of the Zoological Society to know that I have just received a postcard from Mr. Pasteur, of Batavia, announcing that he has in his possession a whole family (♂, ♀ and young) of *P. melanurus*, captured in the neighbourhood of Batavia, which he intends to present to our Museum. Within a few weeks, I hope to get them, preserved in spirit, and to be able to give a more detailed description of the specimens and their skeletons &c.”

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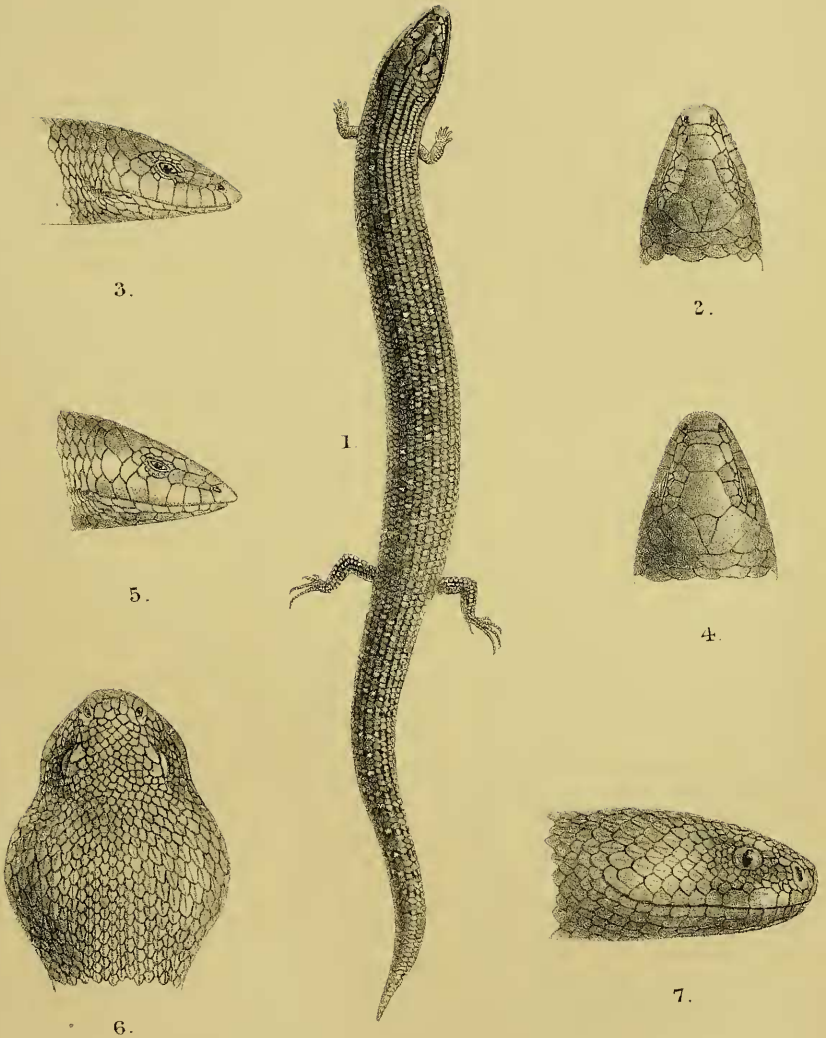
Mr. Ernst Hartert exhibited 31 clutches of eggs of different birds’ eggs associated with eggs of *Cuculus canorus*, mostly collected by himself and reliable friends. He made remarks about the mimicry of the egg in the *Cuculidae*, and observed that some of the Indian species of this family illustrate this fact much better than the European Cuckoo.

Although attempts had been made to prove the contrary, one individual female Cuckoo in his opinion always laid similarly coloured eggs. To prove this fact he called attention to several series of eggs that had apparently been laid by one female. In every case the eggs of the same female were entirely similar to each other in form, size, and colour.

As a very remarkable fact Mr. Hartert mentioned that as regards the dark closed nests of the Common Wren no adaptation of the egg of the Cuckoo to the eggs of the owner had ever been noticed.

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The following papers were read:—





1. On a small Collection of Mammals, Reptiles, and Batrachians from Barbary. By JOHN ANDERSON, M.D., LL.D., F.R.S.

[Received November 31, 1891.]

(Plate I.)

The Mammals, Reptiles, and Batrachians enumerated in the following notes were obtained either by myself in Algeria and Tunisia, or by my collector at Duirat, in the latter region, on the confines of Tripoli. But besides these, several species of Reptiles from the Sahara, purchased from a collector at Biskra<sup>1</sup>, are also included in the list. The specimens collected by me were acquired between December and the beginning of May, and those captured by my collector between the middle of May and the end of June.<sup>2</sup>

The weather experienced in Algeria, in the winter and spring of 1889-90, was very unfavourable to collecting natural history specimens, and more especially reptiles. In Algiers itself, from the end of November until the 7th February, there was a succession of rainless intervals followed by protracted periods of wet weather accompanied with high winds, and so cold that fires were indispensable while the wet weather lasted. During these storms what fell as rain in the lower altitudes of the Tell, came down as snow on the Atlas and the high plateaux, a cold wind blowing from off their heights. On the 10th February I encountered snow a *metre* in depth on Mount Beni Salah (5379 ft.) above Blidah, at an elevation of about 1200 to 1500 ft. below the summit; and M. Lataste records that, on the 22nd April 1881, the rain and hail that fell at that elevation on this mountain prevented him from passing beyond the farm called *La Glucière*, where snow is stored for use in summer at Algiers. This bad weather was not confined to the neighbourhood of Algiers, because, while there, there were constant reports coming in of heavy snow in Kabylia, at Setif, Constantine, and Batna, and indeed over the high plateaux generally, these storms occasionally making themselves felt as far south as Biskra, whence it was reported

<sup>1</sup> The localities in which the specimens had been captured were in every instance carefully noted on the bottles.

<sup>2</sup> The following is a list of the localities visited by me, with the altitudes of some of them, and the date when I was at each:—Algiers, Nov.-7 Feb.; Blidah, on the southern slope of the plain of the Metidji, 7th-12th Feb.; Hammam R'irha, 1800 ft., 12th-27th Feb.; Oran, 27th Feb.-6th March; Tlemçen, 2500 ft., 6th-11th March; Oran, 11th-13th March; Milianah, 2400 ft., 13th-19th March; Algiers, 19th-31st March; Tizi Ouzou, 31st March; Fort National, Kabylia, 3153 ft., 1st April; Tizi Ouzou, 1st-2nd April; Bordj Bouira, 2nd April; Bougie, 3rd-5th April; Kharata, Chabet el Akhira, 1230 ft., 5th-8th April; Setif, 3573 ft., 8th-10th April; Constantine, 2093 ft., 10th-15th April; Biskra, 360 ft., 15th-22nd April; Constantine, 22nd-23rd April; Hammam Meskoutine, 23rd-28th April; Souk el Arba, plain of the Medjeida, Tunisia, 29th April; Tunis, 30th April-12th May.

that a heavy fall of rain had caused the collapse of some of the mud-houses of that oasis. While at Tlemçen, in the beginning of March, after experiencing two delightful days of bright sunshine, during which lizards began to show themselves, we were driven from it by a storm of rain and sleet, accompanied by a biting wind from the south-west, the direction from which these storms generally came, that lasted for two days. About this period, the railways that run southwards from Oran to the Sahara were blocked with snow. At Oran the weather was equally unsettled, clear intervals of sunshine alternating with days of heavy rain. At Milianah, on the morning of the 18th March, we awoke to find the tops of the houses and the ground covered with snow, and, during a previous storm, towards the end of February, snow had fallen as low as Hammam R'irha. At Algiers we were delayed for thirteen days (19th March to 31st), waiting until the snow had disappeared from the mountain in Kabylia on which Fort National stands. At Kharata, at the head of the gorge Chabet el Akhira, we were storm-stayed for three days, as torrential rains, lasting for two days, had carried away parts of the road behind and in front of us. When we had arrived on the treeless plateau on which Setif stands, the frost was so intense on the morning (10th April) on which we left it, that every pool was frozen. The evening of the day following our arrival at Biskra, the wind rose with violence from the north accompanied by heavy rain which continued through the night and part of the next day. The Oued Biskra was so flooded by this storm from the Aures mountains, that the route to Sidi Okha which lies across it was closed for a day. My experience of an Algerian winter I was told was quite exceptional; but, since my return to this country, I have studied with interest the reports of the weather experienced in Algeria last winter, and I find that it has been even more exceptional than the previous winter. Snow fell in Algiers itself, and so heavily in Tunisia that native houses broke down under its weight, while some deaths from cold were recorded. In the west also it was very severe, as some anxiety was felt, during one of the storms, for an outlying village near Tlemçen which had become completely isolated, by reason of the snow that surrounded it. In connection with these observations on the winter climate of Algeria, I observe M. Lataste mentions the spring of 1881 was so little advanced by the middle of May, when he was at Bougie, that he was compelled to turn southwards. It was only when we had travelled as far west as Hammam Meskoutine, removed somewhat from the direct influence of the storms that come up from the Atlantic, that we began to experience genial weather and bright sunshine, under the influence of which snakes and lizards began to shake off the torpidity of winter, and by the time we had reached Tunis, 30th April, the heat in the sun had become so great that I abandoned the intention I had formed of going to Duirat, and sent my collector there instead.

I have given these details regarding the weather encountered in Algeria in 1889-90 because the character of the winter climate does not appear generally known, and as they serve to explain, to a

great degree, why the collection of reptiles made by me is so comparatively meagre.

M. Lataste, the most recent and successful investigator of the Vertebrate fauna of Barbary, has recorded his observations on the Mammalia inhabiting that region in two works<sup>1</sup>. He has been able, by his collections and extensive researches in the country and by the labours of other naturalists, to bring up the number of Mammalian species inhabiting Barbary to 84.

Among the eleven species of small Mammalia found by me the only one calling for special remark is *Plecotus auritus*, obtained by my collector in considerable numbers at Duirat. The interest attached to these specimens is that, while the species is an addition to the fauna of Tunisia, it is only the second time that it has been reported from Barbary. M. Loche had observed a specimen in the flesh, at Blidah, in the hands of a child who had caught it; but M. Lataste was of the opinion that the species was one of eight included by M. Loche in his list of Mammals of Algeria, all of which would probably be ultimately erased from the list. This however, is included by M. Lataste in his Catalogue along with the other seven.

Another valuable result of M. Lataste's labours was read before this Society on the 18th November last. I refer to Mr. Boulenger's "Catalogue of the Reptiles and Batrachia of Barbary, based chiefly upon the notes and collections made by M. Lataste in 1880-84." Long before his Catalogue was finally printed off, Mr. Boulenger very kindly gave me the use of a set of proofs to assist me in naming my specimens, and by their aid, and by means of the excellent keys and concise descriptions embodied in the Catalogue, the identification of the specimens was easily accomplished, even in so difficult a genus as *Acanthodactylus*.

Moreover, as the specimens, after they had been referred to their respective species, were compared with the representatives of the species in the British Museum, I have every confidence that each has been correctly named.

Mr. Boulenger's Catalogue enumerates 64 species of Reptiles and 10 species of Batrachians, whereas my small collection contains only 33 Reptiles and six ecaudate Batrachians, none of the caudate forms having been obtained. Mr. Boulenger has given a most instructive list illustrating in tabular form the distribution of the Reptilia and Batrachia of Barbary; and the only addition these specimens make to it is the extension of the range of *Lacerta ocellata*, var. *tangitana*, to the Tell region of Algeria, in the Province of Oran.

At Duirat, in Tunisia, a locality where apparently forms distinctive of the Tell and of the fauna of the Sahara meet, and which in position seems to bear much the same relation to the Tunisian desert that Biskra has to the Algerian Sahara, my collector obtained one

<sup>1</sup> "Étude de la Faune des Vertébrés de Barbarie: Catalogue Provisoire des Mammifères Apélagiques Sauvages," Actes de la Soc. Linnéenne de Bordeaux, t. xxxix. pp. 129-289. And as a separate work, 1885. Catalogue Critique des Mammifères Apélagiques Sauvages de la Tunisie, 1887.

well-marked new species of the genus *Chalcides*, of which I give a description and three figures, accompanied, for the sake of comparison, by two views of the head of its nearest ally, *C. sepoidea*, Audouin.

At the same place my collector also found a Viper distinctly referable to *V. lebetina*, but, at the same time, differing so much from the typical form, in some of the details of its structure, that I have had no other course left me but to describe it as a variety.

## MAMMALIA.

### Order CHIROPTERA.

#### Family I. RHINOLOPHIDÆ.

##### Genus RHINOLOPHUS, Geoffroy.

1. *RHINOLOPHUS EURYALE*, Blasius; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 65.

1 ♂, cave at Hammam Meskoutine, Province of Constantine.

#### Family II. VESPERTILIONIDÆ.

##### Genus PLECOTUS, Geoffroy.

2. *PLECOTUS AURITUS*, Linnæus; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 66.

2 ♂ & 14 ♀, Duirat, Tunisia.

Beyond M. Loche's statement<sup>1</sup> that he saw a specimen of this Bat in the hands of a child at Blidah, I am not aware of any other notice of its occurrence in Algeria, and this is the first time it has been reported from Tunisia. The foregoing specimens, instead of being light brown, are pale ashy on the upper surface, the light colour generally distinctive of this Bat in desert regions.

##### Genus VESPERUGO, Keys. & Blas.

3. *VESPERUGO KUHLI*, Natterer; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 70; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 2.

1 ♂ & 1 ♀<sup>2</sup>, Duirat, Tunisia.

<sup>1</sup> Cat. des Mammif. et des Oiseaux observés en Algérie, 1858, sp. 43.

<sup>2</sup> The wing and interfemoral membranes of one of these Bats are torn and shrivelled up in places along the margins to such an extent that the flight of the animal must have been materially affected by it. Here and there over the surfaces of the membranes, and elsewhere on the body, there are dense colonies of a minute white *Acarus*, and it seems probable that the irritation produced by them had set up inflammation resulting in the partial destruction of the membranes, which also, when held against the light, were seen to be covered with small black spots, doubtless old inflamed areas due to the same cause. Mr. A. Michael kindly undertook to determine the nature of these *Acari*. The following are his remarks:—

"The *Acari* submitted to me belong to two species only, and are all immature. "The first is a single specimen of the nymph of one of the Ixodidæ, and



This widely distributed Bat was recorded from the Tunisian Chotts by M. Lataste in 1885, and again, in 1885, from El Hammam de Cabes, at the eastern extremity of these salt-water lakes of Tunisia.

Genus *MINIOPTERUS*, Bonaparte.

4. *MINIOPTERUS SCHREIBERSI*, Natterer; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 75.

2 ♂ & 2 ♀, cave at Hammam Meskoutine, Province of Constantine.

The most easterly point in the distribution of this Bat recorded by M. Lataste was Cape Okas, near Bougie. This new locality brings it close to Tunisia, in which province, however, it has not yet been observed.

Order INSECTIVORA.

Family I. *MACROSCOLIDIDÆ*.

Genus *MACROSCOLIDES*.

1. *MACROSCOLIDES ROZETI*, Duvernoy; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 77; id. Cat. Crit. des Mammif. Apélagiques Sauvages, 1887, p. 4.

2 ♂ & 2 ♀, Duirat, Tunisia; 1 ♀, hills behind Biskra.

This species has been found at Mount Santa Cruz, Oran (in the Tell), whence also probably came the specimen from which Duvernoy described the species. It likewise inhabits the high plateaux, and has been recorded from (north to south) Aïn Oussera, about 3000 ft. above the sea, Djelfa, 3792 ft., Aïn el Ibel, about 3700 ft., and also from the slopes tending to the Sahara, such as Laghouat, 2437 ft., and Bou Sâada, 1900 ft. The specimen recorded by me from Biskra, 360 ft. above the sea-level, was not obtained at this elevation, but from the hills behind, at what height I cannot say. M. Lataste

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belongs to the genus *Hyalomma* (Koch). The species seems to be either the *Ixodes flavipes* of Koch or the *I. vespertilionis* of the same author; it is not possible in the present state of our knowledge to identify it with certainty from immature specimens, but it is probable that the two species are not really distinct; both have been recorded as bat-parasites, the former by Kolenati, the latter by Koch. According to modern classification this Acarid would belong to the genus *Hyalomma*, not *Ixodes*.

“The other Acarid, of which there are numerous examples, was found by Dr. Anderson upon the same Bat and upon *Plecotus auritus*; it is one of the creatures described by Kolenati as forming the genus *Peplonyssus*; the species is probably his *P. crucipecta*. These *Peplonyssi* are all bat-parasites; but, although I am not sure that the fact has been publicly recorded, I think there can be no doubt that all the species of the genus are larval forms of Ixodidæ, the adults of which we may or may not be acquainted with, but which cannot at present be identified with the larvæ.”

has recorded it from Batna, 3350 ft., on the high plateaux immediately to the north of Biskra, and he has mentioned specimens from the region of the Tunisian Chotts, Feriana and Djebel Bou-Hedma, Tunisia, but none so far from the east as Duirat.

The female from Biskra I had alive in my possession from the 17th April until the 22nd May. I brought it alive to Switzerland, but, after it had been eight days in Europe, it died, possibly from eating food unsuited to it. In Algeria, but more especially in Tunis, I experienced no difficulty in obtaining house-flies wherewith to feed it, and on which it thrived, but, on my arrival in Europe, these insects were so scarce that I had first to offer it the larvae on which bird-fanciers feed small insectivorous birds. These it ate for a day or two, but, as it afterwards refused to touch them, I had next to try it with small cockroaches. These, however, did not appear to agree with it, and in two days more it was dead.

It was very expert in catching flies, and as it never attempted to jump off any great height, I used to place it on a table, covered with a white cloth, and to scatter maimed flies over the table. When it once caught sight of a fly it made a rapid rush at it, the mobile proboscis touched the fly, and it disappeared, the Shrew seldom allowing one to escape. The tongue is remarkably long, exceeding the length of the snout, on the under surface of which there is a well-marked groove along which possibly the tongue is projected, assisting in the seizure of the insect prey. In its natural haunts, the proboscis is probably introduced into crevices where insects lurk.

It was so tame that it was generally placed on the breakfast table, on which it ran perfectly at home, occasionally picking up minute hard crumbs from the outsides of "*croissants*" or fragments of biscuits. It used also to lap milk freely from a spoon, returning every now and again to do so, and, if it had had its own way, it would have gorged itself with butter, but with disastrous effects, as a small quantity acted on it as a laxative.

Its great delight while on the table was to get under a covert of some kind, and to run from one shelter to another, now and again darting out suddenly when it saw a fly. It never attempted to bite, and it seemed to enjoy being held in the hands, the heat and cover afforded by them being grateful to it. In this position it would remain for a long time, making no effort to move.

Its sense of hearing was acute, more especially to sharp sounds, any shrill call at once startling it, whereas dull sounds it seemed to heed but little. With regard to its vision, I may mention that while it had a keen eye for small objects in motion, I could wave my arms in front of it, a few feet off, without scaring it.

Its movements were extremely rapid, and in ordinary progression it never jumped, but was projected forwards, so to speak, in short runs, ever and anon stopping abruptly to look about.

Measurements of *Macroscelides rozeti*.

	♂.	♂.	♀.	♀.	♀.
	millim.	millim.	millim.	millim.	millim.
Tip of snout to vent.....	104	94	108	105	95
Vent to tip of tail without hairs...	114	112	110	117	100
Tip of snout to upper incisors.....	14	13	13	14	14
Length of hind foot with claws ...	31	31	32	32	32
Height of ear .....	29	29	31	30	28
Breadth of ear .....	20	20	20	22	19

There were two fœtuses in the right horn of the uterus of one of these females, a similar number having been recorded by M. Lataste in an individual which he examined. In his specimen they were still very young on the 10th May, whereas in my specimen, captured in June, they were covered with hair and evidently mature. The weight of one of the fœtuses was 28 grains without the placenta.

## Family II. SORICIDÆ.

## Genus CROCIDURA, Wagler.

2. CROCIDURA ARANEA, Linnæus; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 82; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 6.

1 ♀, environs of Algiers.

Snout to vent 55 millim.; vent to tip of tail 35 millim.; hind foot and claws 13 millim.

## Order RODENTIA.

## Family I. MURIDÆ.

Subfamily *Gerbillinæ*.

## Genus GERBILLUS, Desmarest.

1. GERBILLUS CAMPESTRIS, Levaillant; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 142; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 24.

1 ♂, Duirat, Tunisia.

Measurements of *G. campestris*.

	♂.
	millim.
Tip of snout to vent. . . . .	90
Vent to tip of tail without hairs . . . . .	114
Height of ear . . . . .	15
Length of hind foot with claws . . . . .	27
Occiput to vent . . . . .	32

This form in its four subarticular and two tarsal tubercles=  
*Dipodillus*.

## 2. GERBILLUS SHAWI, Rozet.

*Meriones shawi*, Rozet; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 114; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 27.

5 ♀ & 1 ♂, Duirat, Tunisia.

Measurements of *G. shawi*.

	♀.	♀.	♀.	♀.	♀.	♂.
	millim.	millim.	millim.	millim.	millim.	millim.
Tip of snout to vent.....	135	128	117	77	73	74
Vent to tip of tail without hairs .....	125	117	119	63	67	69
Height of ear .....	15	13	13	11	11	11
Length of hind foot and claws .....	33	33	33	26	26	27
Occiput to snout .....	41	39	38	30	29	30

The largest female was gravid (June), and had four foetuses, well advanced, in each horn of the uterus.

Subfamily *Murinae*.Genus *MUS*, Linnæus.

3. *MUS MUSCULUS*, Linnæus; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 135; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 22.

1 ♀ juv., Biskra; 2 ♂, Hammam Meskoutine, Province of Constantine; and 1 ♂, Duirat, Tunisia.

## Family II. OCTODONTIDÆ.

Genus *CTENODACTYLUS*, Gray.

4. *CTENODACTYLUS GUNDI*, Rothman; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 152; id. Cat. Crit. des Mammif. de la Tunisie, 1887, p. 31.

2 ♀ & 1 ♂, Duirat, Tunisia.

This species is said to be common on the hills behind Biskra.

## Family III. DIPODIDÆ.

Genus *DIPUS*, Gmelin.

5. *DIPUS HIRTIPES*, Lichtenstein; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 150; id. Cat. Crit. des Mammif. &c. 1887, p. 30.

1 ♀, Biskra.

This female gave birth to two young ones while in my possession (27 April), but made no visible effort to rear them.

The animal burrowed in loose earth with great rapidity, completely disappearing in a remarkably short time, driving the earth backwards with its hind feet, and, as it accumulated behind them, turning and pushing it out of the burrow with its broad hairy snout.

## REPTILIA.

### Order CHELONIA.

#### Family I. TESTUDINIDÆ.

##### Genus TESTUDO, Linnæus.

1. TESTUDO IBERA, Pallas ; Boulenger, Trans. Zool. Soc. London, vol. xiii. pt. iii. 1891, p. 104.  
5, neighbourhood of Algiers ; 2, Duirat, Tunisia.

##### Genus CLEMMYS, Wagler.

2. CLEMMYS LEPROSA, Schweigger ; Boulenger, *loc. cit.* p. 106.  
3 ♀, Duirat, Tunisia.  
I also obtained a specimen of this species at Biskra, but it escaped.

### Order SQUAMATA.

#### Suborder I. LACERTILIA.

##### Family I. GECKONIDÆ.

##### Genus HEMIDACTYLUS, Gray.

1. HEMIDACTYLUS TURCICUS, Linnæus ; Boulenger, *loc. cit.* p. 115.  
1 ♀, Hammam R'irha, Province of Algiers.

##### Genus TARENTOLA, Gray.

2. TARENTOLA MAURITANICA, Linnæus ; Boulenger, *loc. cit.* p. 115.  
1, Biskra ; 3, walls of old tombs outside the Bab Alewa, Tunis ; 21, Duirat, Tunisia.

Among these specimens there are examples of the typical form and of the variety *deserti*. The specimen from Biskra is an example of the latter, but the Geckos from Tunis belong to the typical form, which also occurs at Duirat, along with the variety, the Saharian and Tell faunæ meeting at that locality.

##### Family II. AGAMIDÆ.

##### Genus AGAMA, Daudin.

3. AGAMA INERMIS, Reuss ; Boulenger, *loc. cit.* p. 117.  
2, from between Biskra and Tuggurt ; 1 ♀, Tuggurt ; 2 ♂ & 4 ♀, Duirat, Tunisia.

The largest female measures from the snout to the vent 94 millim., and the tail 125 millim.

These specimens illustrate the unequal lepidosis of the back mentioned by Mr. Boulenger, as no two are alike in the distribution of the enlarged scales.

The Duirat specimens collected in the months of May and June are gravid.

#### Genus UROMASTIX, Merrem.

4. UROMASTIX ACANTHINURUS, Bell ; Boulenger, *loc. cit.* p. 119.  
2, Biskra ; 2, Duirat.

#### Family III. VARANIDÆ.

##### Genus VARANUS, Merrem.

5. VARANUS GRISEUS, Daudin ; Boulenger, *loc. cit.* p. 121.

1 ♀, Duirat, Tunisia.

Mr. Boulenger gives the dimensions of this species as follows :— snout to vent 56 centim., tail 71 ; but this female, although it is 22 centimetres shorter in its body, is gravid, having 7 ova in the right, and 8 in the left ovary, the ova on the right side being pressed forwards almost as far as the axilla.

#### Family IV. AMPHISBÆNIDÆ.

##### Genus TROGONOPHIS, Kaup.

6. TROGONOPHIS WIEGMANNI, Kaup ; Boulenger, *loc. cit.* p. 122.  
2, Hammam Meskoutine, Province of Constantine, under large stones on hill-sides.

#### Family V. LACERTIDÆ.

##### Genus LACERTA, Linnæus.

7. LACERTA OCELLATA, Daudin ; Boulenger, *loc. cit.* p. 123.

Var. PATER, Lataste, 1880 ; Boulenger, *loc. cit.* p. 123.

2 ♂, under hedges by the road-side, Tlemsen, Province of Oran ;  
1 ♀, under a large stone, Hammam Meskoutine, Province of Constantine ; 2 ♂ & 2 ♀, Duirat, Tunisia.

M. Lataste was the first to point out that the large lizard of Algeria and Tunisia was a race or subspecies of *L. ocellata*, closely related to it, but having also some points of affinity with *L. viridis*. Mr. Boulenger adopts this view, with which I fully agree, and in his catalogue he clearly indicates wherein it differs from the European form.

In none of these specimens does the number of scales across the back exceed 80, nor are the femoral pores more than 16.

7a. var. TANGITANA, Boulenger, Catalogue of Lizards in the

Brit. Mus. 1887, vol. iii. p. 13, pl. iii. fig. 1; et *loc. cit.* p. 124.

1 young, Tlemgen, Province of Oran.

This variety was founded by Mr. Boulenger for the reception of some lizards from Tangier, very nearly allied to the previous variety, but differing from it and from *L. ocellata typica* in their much smaller dorsal scales, numbering from 77 to 100 across the middle of the body, and in their more numerous (17–21) femoral pores. On the other hand, in their smaller occipital and in the number (6–8) of the longitudinal rows of ventral scales, they manifest, as pointed out by Mr. Boulenger, marked affinities to the Spanish-Portuguese form of *L. viridis*, the var. *schreiberi*, Bedriaga, and so closely do they resemble it in these two respects that they are undistinguishable from it. Until the discovery of these specimens from Tangier, *L. ocellata* and *L. viridis* were unknown from Morocco. It is interesting therefore to find the Morocco variety occurring at Tlemgen, but not surprising, considering the proximity of this locality to Morocco. This specimen, however, presents one variation by which it can be distinguished from all the examples of var. *tangitana* in the British Museum, and that is, that the shields along the collar are much more numerous, being 22, whereas in vars. *pater* and *tangitana* there are only 10 or 11 shields. This is not at all likely to be an individual variation, and hence it is interesting to find the outlying members of the variety so modified.

The specimen in question is unfortunately young, as it measures only 47 millim. from the snout to the vent, but in all its other characters it resembles var. *tangitana*. The dorsal scales are very small, and number 87 across the middle of the body; there are 18 femoral pores, 8 longitudinal rows of scales on the belly, and the occipital shield is decidedly narrower than the interparietal, all distinctive features of *L. ocellata*, var. *tangitana*.

8. *LACERTA MURALIS*, Laurenti; Boulenger, *loc. cit.* p. 125.

3 ♂ & 3 ♀, Tlemgen, Province of Oran.

These lizards resemble the specimens of this species from Tangier described by Mr. Boulenger as having the scales very small, obtusely keeled and in 61 to 73 rows across the middle of the body, but in some of them they fall to 56. Their upper caudal scales are also strongly keeled as in specimens from Tangier. The femoral pores vary from 17 to 21, whereas in examples from the latter district they vary from 13 to 19, 17 being the usual number.

One of the above males is coloured exactly like the specimens from Tangier in the British Museum, but another and two females are less spotted with black, and the white spots on the tail, so marked in Tangier specimens, are absent, or only feebly indicated.

9. *LACERTA PERSPICILLATA*, Dum. & Bibr.; Boulenger, *loc. cit.* p. 126.

2 ♂, Santa Cruz, Oran.

In these specimens there are 56 and 60 scales across the middle

of the body, the highest number mentioned by Boulenger being 56 ; and in the smaller of the two specimens there are six upper labials before the subocular on one side and seven on the other, the usual number of these shields being five.

Genus *PSAMMODROMUS*, Fitzinger.

10. *PSAMMODROMUS ALGIRUS*, Linnæus ; Boulenger, *loc. cit.* p. 128.

1 ♀, Tlemçen, Province of Oran.

Genus *ACANTHODACTYLUS*, Wiegmann.

11. *ACANTHODACTYLUS BOSKIANUS*, Daudin ; Boulenger, *loc. cit.* p. 129.

1 ♂, Biskra ; 1 ♂ & 1 ♀, Tuggurt ; 1 ♂ & 3 ♀, Duirat, Tunisia.

The ventral plates in these specimens do not exceed 10, and the highest number of large keeled scales between the hind limbs is 11 ; but this occurs only in one specimen, all the others having 10 longitudinal rows.

Five of the seven specimens have 23 femoral pores on each side, one 19, and the other 24. The longitudinal series of scales round the middle of the body vary from 30 to 36, the lowest number occurring in a specimen from Duirat.

12. *ACANTHODACTYLUS SCUTELLATUS*, Audouin ; Boulenger, *loc. cit.* p. 130.

1 ♂ & 4 ♀, Tuggurt ; 3 ♂ & 2 ♀, Duirat, Tunisia.

These specimens are all distinguished by acute snouts, denticulated ears, and by the dorsal and ventral scales merging the one into the other, these scales conjointly varying from 60 to 70 (Mr. Boulenger gives 61-74) ; the scales referable to the ventral region vary from 12 to 14, the latter number being dependent on the degree of development of the outermost series of scales, but in Mr. Boulenger's specimens the number rose to 18. The lowest number of femoral pores, 18, occurs in a female specimen from Tuggurt, whereas the highest number 26, is found in a male from Duirat, the range of femoral pores recorded by Mr. Boulenger being from 18 to 25.

The three males from Duirat are reddish, with numerous black spots and indications of white ocelli on the sides, whereas the females from the same locality are uniformly reddish, with the white ocelli feebly visible, and the black spots only faintly traceable here and there. The Tuggurt specimens are olive-grey. In the male from this locality the black spots are more distinctly marked than in the females.

13. *ACANTHODACTYLUS PARDALIS*, Lichtenstein ; Boulenger, *loc. cit.* p. 131.

3 ♂, Aures Mountains, north of Biskra ; 7 ♂ & 8 ♀, route between Biskra and Tuggurt ; 3 ♂ & 7 ♀, Duirat, Tunisia.



The specimens from the first-mentioned locality belong to the variety named *bedriagæ* by M. Lataste, whilst the others, which are distinguished from them by being more slender and somewhat smaller, may be taken as representing the variety *deserti* (*Zootoca deserti*, Günther). However, as Mr. Boulenger points out, not only are these varieties ill-defined, but the former approaches *A. vulgaris* in its structure and coloration, whilst the latter often closely resembles *A. scutellatus*. This species (*A. pardalis*) is thus a transitional form.

Among the specimens recorded above, the scales round the middle of the body, including the ventrals, vary from 61-74, whereas in Mr. Boulenger's specimens the variation is from 66-82. The femoral pores also are variable, as in my specimens the lowest number is 15 and the highest 22, whilst the numbers recorded by him are 15-25.

14. ACANTHODACTYLUS VULGARIS, Dum. & Bibr.; Boulenger, *loc. cit.* p. 131.

4 ♂ & 3 ♀, Mount Santa Cruz. On old walls at the foot of the hill.

In these specimens the subocular enters the labial border, and in five out of the seven it does so more or less broadly. In one of the remaining two the sharp lower angle of the shield is wedged in between the labials as a fine point, while in the seventh specimen it is excluded from the labial border on one side, but preserves the same character as the previous specimen on the opposite side. Unlike Moroccan examples of this lizard, the tendency of this shield is to enter largely into the formation of the lip.

In none of the specimens does the number of the scales round the body, including the ventrals (8), exceed 77, nor fall lower than 73. The femoral pores vary from 23 to 26.

They are marked with six longitudinal whitish lines, separated from each other by broad dark brown bands; but in the largest specimen the white lines are more or less broken up into white spots, the intervening dark bands being reticulated with brick-red. The limbs are white spotted, and the end of the tail is pink.

#### Genus EREMIAS, Wiegmann.

15. EREMIAS GUTTULATA, Lichtenstein; Boulenger, *loc. cit.* p. 132.

1 ♂, between Biskra and Tuggurt; 1 ♂, Tuggurt, and 1 ♀, Duirat.

These three specimens have the median disk of the eyelid broken up into 4, 5, and 6 scales respectively, with the collar distinct only at the sides. In the variations tabulated by Mr. Boulenger, the form with the collar distinct at the sides has only two scales in the transparent palpebral disk, the highest number, four, recorded by him occurring in specimens with the collar free all round. In specimens presenting these two kinds of variation in the collar and in the

palpebral disk, the number of scales round the middle of the body is 52, the femoral pores being 10-10 in the first variation, and 11-10 in the second, whereas in my specimens the scales round the body (including the ventrals) are 52-53, and the femoral pores are 11-14. In Mr. Boulenger's specimens with six scales in the palpebral disk, and with the collar distinct and attached in the middle, the femoral pores are 14-13, while in the above-mentioned specimen, with the same number of scales in the palpebral disk, there are only 11 femoral pores, associated with 53 scales (including the ventrals) round the body, whilst his specimens have 59 scales. Mr. Boulenger indicates another variation with 3 scales in the palpebral disk, 68 scales (including ventrals) round the body, and with 17-17 femoral pores. These facts attest the correctness of M. Lataste's opinion, which Mr. Boulenger shares, that no division of this species into subspecies or varieties can be made on characters derived from the palpebral disk and collar.

#### Family VI. SCINCIDÆ.

##### Genus MABUIA, Fitzinger.

16. *MABUIA VITTATA*, Olivier ; Boulenger, *loc. cit.* p. 135.

1, Djebel Ahmer Khaddon, south of Constantine ; 1, Biskra ; 1, between Biskra and Tuggurt.

The largest specimen is from the first-mentioned locality, and measures, from the snout to the vent, 75 millim., the tail 129.

##### Genus EUMECES, Wiegmann.

17. *EUMECES SCHNEIDERI*, Daudin ; Boulenger, *loc. cit.* p. 136.

1 ♂ & 2 ♀, Duirat, Tunisia.

##### Genus SCINCUS, Laurenti.

18. *SCINCUS OFFICINALIS*, Laurenti ; Boulenger, *loc. cit.* p. 137.

1 ♂, Sand-dunes, Debila, Sahara ; 1 ♂ & 3 ♀, Tuggurt ; 1 ♂ & 3 ♀, Duirat, Tunisia.

In one of the specimens from Duirat there are 30 scales round the body, in the other 26-28. These specimens present two types of coloration, being either uniformly yellowish above or marked in addition with dark brown bars more or less continuous across the back, strongly or obscurely developed.

##### Genus CHALCIDES, Laurenti.

19. *CHALCIDES OCELLATUS*, Forskål ; Boulenger, *loc. cit.* p. 138.

11, Biskra ; 1, Djebel Ahmar Khaddon, south of Constantine ; 6, Duirat, Tunisia.

The largest specimen is 116 millim. from the snout to the vent, and, in one measuring 104 millim., the hind limb is 25 millim. The scales round the body vary from 28-32 in number, whereas those

described by Mr. Boulenger had never more than 30. The specimens from Duirat are all marked with white ocelli or shafts in black spots, the general colour of the upper surface varying from dark brown to dark grey, without any trace of the broad dorsal band of a darker hue which occurs in all the Biskra specimens, none of which are of a grey tint. In some specimens from Biskra the ocelli are practically absent or only obscurely indicated.

19 *a.* var. *TILIGUGU*, Gmelin.

1, Tlemçen, Province of Oran; 1, Mount Santa Cruz, Oran; 1, Hammam R'irha, Province of Algiers; 2, Hammam Meskoutine, Province of Constantine; and 3, Duirat, Tunisia.

These specimens are stouter than the previous form and larger, reaching 144 millim. from the snout to the vent. The limbs also are longer, as in one individual measuring 105 millim. from the snout to the vent the hind limb is 29 millim. The scales round the body vary from 30–32. In all of them there is a broad dorsal band with a lighter-coloured broad band on either side of it, and all are ocellated. The Duirat specimens are much paler than those from the Tell.

20. *CHALCIDES BOULENGERI*, sp. nov. (Plate I. figs. 1, 2, 3.)

2 specimens, Duirat, Tunisia.

Snout wedge-shaped, not so broad as in *C. sepoides*, Audouin, but with a projecting labial edge; eye small, but slightly larger than in *C. sepoides*; ear-opening an oblique slit at the commissure of the mouth, but with a fringe of three pointed scales. The nostril is not in advance of the suture between the rostral and the first labial; supranasals fused into a single shield; frontal as broad or a little broader than long; four supraoculars, with four small scales below them; fifth labial enters the orbit. The limbs are weak, but stronger than in *C. sepoides*; the hinder pair are proportionally more developed than the front limbs. The hind limbs are penta- or tetradactyle, and in length each equals about the distance between the fore limb and the nostril; the latter limb equals considerably more than half its distance from the centre of the eye, and is pentadactyle<sup>1</sup>. The body is not quite so long as in *C. sepoides*, and the sides are angular as in that species. Twenty-eight rows of scales round the body.

Yellowish above, each scale finely margined with dark brown, their centres whitish and presenting, in some instances, the appearance of ocelli, recalling the ocellation characteristic of *C. ocellatus*, and this is unmistakably marked especially on the tail, on which the ocelli are arranged in more or less transverse rows. A black line through the eye, and two fine black lines on either side of the frontal. The

<sup>1</sup> In one specimen the *manus* is entirely absent on one side, but this is probably due to an accident.

black margins of the scales on the nape tend to form longitudinal lines.

No. 1. Snout to vent 83 millim., tail 60, hind limb 17.

No. 2. „ „ „ 83 „ „ 45<sup>1</sup>, „ „ 17.

This species is distinguished from *C. sepoides* (Plate I. figs. 4, 5) by the nostril not being placed in advance of the suture between the first labial and the rostral; by the fifth labial entering the orbit, whereas in *C. sepoides* it is the fourth that does so; and by 28 rows of scales round the body, whilst in that species these scales never exceed 24.

The ear is much the same as in *C. sepoides*, but it is very different from the ear of *C. ocellatus* and that of *C. mionecton*, in which it is a round well-marked opening, further removed from the angle of the mouth.

It is linked by the character of its labial edge and rostral to *C. sphenopsiformis* (Senegambia), which through *C. mionecton* connects it with *C. ocellatus*. It thus supplies a link that was wanting in the chain of these species, so to speak.

I have much pleasure in connecting Mr. Boulenger's name with this new lizard from Barbary.

## Suborder II. RHIPTOGLOSSA.

### Family I. CHAMÆLEONTIDÆ.

#### Genus CHAMÆLEON, Laurenti.

1. CHAMÆLEON VULGARIS, Daudin; Boulenger, *loc. cit.* p. 142.  
1, Tamerna, Sahara; 3, Duirat, Tunisia.

## Suborder III. OPHIDIA.

### Family I. COLUBRIDÆ.

#### Genus ZAMENIS, Wagler.

1. ZAMENIS ALGIRUS, Jan; Boulenger, *loc. cit.* p. 147.

2 specimens, Duirat, Tunisia.

No. 1. Total length 1000 millim., tail 250. Ventrals 218, subcaudals 104.

No. 2. Total length 920 millim., tail 200. Ventrals 231, subcaudals 87.

In the first specimen there are 8 upper labials on one side and 9 on the other, but in No. 2 there are 9 upper labials on both sides. In No. 1 the fifth labial enters the orbit on the left side, but on the right side the labials are excluded from touching the eye; and in No. 2 a labial, the fifth, enters the orbit on one side only, being excluded on the other by an additional subocular, the labial entering the orbit when there are only two suboculars. The præocular in these specimens has generally two small scales below it separating it from

<sup>1</sup> Renewed.

the labials. The temporals also are variable, as in No. 2 they are 3+3 on one side and 2+3 on the other. The number of subcaudals in No. 1 exceeds the maximum given by Mr. Boulenger, and its anal is entire, while in No. 2 these plates fall below the minimum recorded by him. His figures are 92-100. Their coloration is normal.

2. ZAMENIS HIPPOCREPIS, Linnæus ; Boulenger, *op. cit.* p. 147.

1 specimen, Hammam Meskoutine, Province of Constantine ; 1 specimen, neighbourhood of Algiers.

In the first specimen there are 10 upper labials on one side, and 7o temporals in contact with the postoculars.

3. ZAMENIS DIADEMA, Schlegel ; Boulenger, *op. cit.* p. 148.

1 specimen, Duirat, Tunisia ; 1 specimen, between Biskra and Tuggurt.

The snake from Duirat has 25 rows of scales, and the Biskra-Tuggurt specimen 32. The head-shields present some of the variations usual to this species.

The Duirat specimen has the pale yellowish sandy coloration of a desert form ; the typical dark rhombic markings are distinct, but the horn-colour has a faded appearance.

Genus TROPIDONOTUS, Kuhl.

4. TROPIDONOTUS VIPERINUS, Latr. ; Boulenger, *loc. cit.* p. 149.

1 specimen, Hammam R'irha, Province of Algiers ; 1 specimen, Biskra ; 6 specimens, between Biskra and Tuggurt ; 1 specimen, Duirat, Tunisia.

The first specimen has the rare variation of 23 rows of scales.

Genus MACROPROTODON, Guichenot.

5. MACROPROTODON CUCULLATUS, Geoffroy ; Boulenger, *loc. cit.* pp. 149, 150.

1 specimen, Hammam Meskoutine, Province of Constantine, among stones.

Total length 539 millim., tail 93. Ventrals 171 ; subcaudals 54. It has 19 rows of scales, which is generally the case in Algerian and Tunisian specimens, as pointed out by Mr. Boulenger.

Genus PSAMMOPHIS, Boie.

6. PSAMMOPHIS SIBILANS, Linnæus ; Boulenger, *loc. cit.* p. 150.

1 specimen, Duirat, Tunisia.

Total length 975 millim., tail 341. Ventrals 179 ; subcaudals 131. A partially divided præocular on each side ; 9 upper labials, the 5th and 6th entering the orbit, as in the case of all Algerian and Tunisian specimens found by M. Lataste.

## Genus CŒLOPELTIS, Wagler.

7. CŒLOPELTIS LACERTINA, Wagler; Boulenger, *loc. cit.* p. 151.

1 specimen, Duirat, Tunisia.

Total length 1275 millim., tail 347. Ventrals 170, subcaudals 105; 19 rows of scales.

8. CŒLOPELTIS PRODUCTA, Gervais; Boulenger, *loc. cit.* p. 151.

2 specimens, Duirat, Tunisia.

No. 1. Total length 663 millim., tail 121. Ventrals 161, subcaudals 62.

No. 2. Total length 671 millim., tail 115. Ventrals 159, subcaudals 48.

The first has 9 upper labials on the right side, and the normal number 8 on the left, the 5th and 6th entering the right and the 4th and 5th the left orbit. The grooving of the scales of these specimens is very feebly indicated and in marked contrast to this character in *C. lacertina*.

This appears to be the second record of this snake from Tunisia, the first specimen having been obtained by M. Valéry-Mayet at Bou-Hedma near Gafsa. The species was originally based on a specimen from the Sahara.

## Family II. VIPERIDÆ.

## Genus VIPERA, Laurenti.

9. VIPERA LEBETINA, Linnæus; Boulenger, *loc. cit.* p. 154.

Var. nov. DESERTI. (Plate I. figs. 6 and 7).

1 ♀, Duirat, Tunisia.

I have no hesitation in referring this specimen to *V. lebetina*, but, as it is devoid of a canthus rostralis and has the scales on the head from the parietal region forwards to the rostral perfectly smooth, I regard it as a variety which I propose to call *deserti*.

All authors who have hitherto had occasion to describe *V. lebetina* from Algeria have either directly or indirectly referred to the keeled character of the head-scales. Through the kind assistance of Mr. Boulenger, who examined for me the type (No. 4017) of *V. mauritanica*, Guichenot, in the Paris Museum, I have his authority for stating that the canthus rostralis of that snake is well marked, and that the interorbital scales are feebly but distinctly keeled. It has no large supraoculars, and the rostral is a little higher than broad. It is a female with 163 ventrals and 50 caudals. Another and young specimen, No. 4016 of Guichenot's Collection, is the same as the preceding, but with the canthus rostralis less distinctly marked. It has 166 ventrals and 39 caudals.

I have examined all the specimens of *V. lebetina* in the British Museum, and I give the leading details regarding them in the following table, and for comparison I have added in the last column those yielded by this variety.

Characters of *Vipera lebetina* and var. *deserti*.

Total length (millimetres) .....	1040	Algiers.
" " of tail.....	110	
Ventrals .....	157	Algiers.
Caudals .....	38	
Scales round body .....	25	
Cantinus rostralis, absent (A) or present (P) ...	P	
Scales on upper surface of head keeled (K) ...	K	
or smooth (S).....	K	
Number of upper labials .....	10	
Rostral broader than high (B), higher than broad (H) .....	B	
Supraorbitals variable, some enlarged (V), distinctly enlarged and their number (1E & 2E).....	V	
Seles between eyes, including supraorbitals ...	12	
	740	Algiers.
	95	
	156	
	43	
	25	
	P	
	K	
	K	
	10	
	B	
	V	
	12	
	1043	Cyprus.
	134	
	156	
	45	
	25	
	P	
	K	
	K	
	11	
	B	
	V	
	12	
	613	Cyprus.
	76	
	158	
	43	
	25	
	P	
	K	
	K	
	10	
	B	
	V	
	11	
	595	Cyprus.
	75	
	154	
	43	
	25	
	P	
	K	
	K	
	10	
	B	
	V	
	11	
	1070	Lake of Galilee.
	130	
	170	
	44	
	25	
	P	
	K	
	K	
	11	
	H B	
	V	
	11	
	1375	Persia, Teheran.
	185	
	177	
	50	
	25	
	P	
	K	
	K	
	10	
	B	
	1E	
	11	
	1250	Persia.
	135	
	173	
	46	
	25	
	P	
	K	
	K	
	10	
	B	
	1E	
	9	
	955	Persia.
	115	
	180	
	47	
	25	
	P	
	K	
	K	
	10	
	B	
	1E	
	12	
	Head and neck only.	Sung Hadji, Afghanistan.
	23	
	P	
	K	
	K	
	10	
	B	
	1E	
	11	
	Head and neck only.	Shou' Kaltigni, Afghanistan.
	25	
	P	
	K	
	K	
	10	
	B	
	1E	
	11	
	707	Duirat, Tunisia.
	103	
	167	
	51	
	27	
	A	
	S	
	11	
	H	
	2E	
	11	

I have also given two drawings of its head (Plate I. figs. 6, 7). If these are compared with Guichenot's figure of *V. mauritanica*<sup>1</sup>, which Mr. Boulenger informs me is a good representation of the above-mentioned specimen No. 4017, the differences between this variety and the typical form will be seen to be considerable.

To summarize the features of this variety, the most striking is certainly the entire absence of any approach to keeling on the scales on the upper surface of the head from the parietal region forward to the rostral. As already stated, in all the hitherto recorded specimens of *V. lebetina*, the scales of the head over the foregoing area and over the upper surface of the head generally are keeled in various degrees of intensity, while at the same time they preserve to a great extent the general form and character of the scales on the body. In this variety, on the other hand, the head-scales, besides being perfectly smooth in the region specified, are somewhat unlike those of the body in that they are rounded at their margins and are very flat. The entire absence of the canthus rostralis is another feature by which this variety is distinguished from the typical form, in which it is always defined although less marked in some individuals than in others.

The rostral shield is higher than broad, but in an example of this species from the Lake of Galilee it is as high as broad, a modification which connects this variety with the other specimens mentioned in the foregoing table in which the rostral is decidedly broader than high. The supraoculars in the first six specimens enumerated in the table (p. 21) are not markedly differentiated from the ordinary head-scales as regards their size: occasionally one or more scales may be larger than the others, either on both sides of the head or on one only, but in none of them are two scales so developed as in this variety. On the other hand, the specimens from Persia and Afghanistan can be distinguished at once by the presence of a large supraocular occupying nearly the entire upper border of the eye. It will be observed that, in the labials and the scales between the eyes, the variations among these specimens are very insignificant. It is worthy of attention that the four specimens from the mainland of South-western Asia present a marked increase in the number of their ventrals as compared with the typical form from Algeria and Cyprus, and that the two groups are connected with each other by var. *deserti* from Eastern Tunisia.

In *V. lebetina*, var. *deserti*, the colour is pale yellowish brown above, with very faint indications of the dorsal and lateral dark spots distinctive of Algerian and Cyprian examples of the typical form; and the under surface is pale yellow, almost immaculate anteriorly, the finely powdered aspect of the species being only feebly indicated posteriorly. The specimen from the Lake of Galilee very much resembles the var. *deserti* in colour and general appearance, but it has keeled scales on the head and a canthus rostralis.

I have selected the term *deserti* to designate this variety, because reptiles received from Duirat, the locality from which this Viper

<sup>1</sup> Explor. Sc. Alg., Rept. pl. iii.



was obtained, establish the fact that the Saharian fauna extends to that district, and moreover the Snake has all the features of a desert form.

The majority of the specimens of *V. lebetina* hitherto recorded have come from the Tell region of Western Algeria, but examples of this species have also been mentioned from Batna on the high plateau and likewise from Bona on the coast, in the Tell region. As our knowledge of the northern portion of the Sahara intervening between Duirat and Egypt becomes more extended, it is probable that this variety of *V. lebetina* will be found to occur throughout that district, and, possibly, in Egypt itself.

#### Genus CERASTES, Wagler.

10. CERASTES VIPERA, Linnæus ; Boulenger, *op. cit.* p. 155.

1 ♂ & 1 ♀, Duirat, Tunisia.

♂. Total length 252 millim., tail 32. Ventrals 107, subcaudals 32; rows of scales 23.

♀. Total length 248 millim., tail 22. Ventrals 117, subcaudals 22; rows of scales 23.

Mr. Boulenger mentions that although M. Lataste did not come across this Viper in Tunisia, several specimens from the southern part of that province are in the possession of Marquis Doria.

### BATRACHIA.

#### Order ECAUDATA.

##### Family I. RANIDÆ.

##### Genus RANA, Linnæus.

1. RANA ESCULENTA, Linnæus ; Boulenger, *loc. cit.* p. 157.

5, Algiers ; 4, Hammam R'irha, Province of Algiers ; 3, Biskra.

These specimens belong to the var. *ridibunda*, Pallas, the most widely distributed race, and the only one found in Barbary. Mr. Boulenger has recently given<sup>1</sup> the measurements of the largest of my specimens from the last two of the localities recorded above.

##### Family II. BUFONIDÆ.

##### Genus BUFO, Laurenti.

2. BUFO VIRIDIS, Laurenti ; Boulenger, *loc. cit.* p. 158.

1 young specimen, Laurier-Rose Station on the railway to Tlemçen ; 2 specimens, Duirat.

3. BUFO MAURITANICUS, Schlegel ; Boulenger, *loc. cit.* p. 158.

1 specimen, Tlemçen, Province Oran ; 2 specimens, Hammam R'irha, Province Algiers ; 2 specimens, Algiers ; 2 specimens, Biskra.

<sup>1</sup> Proc. Zool. Soc. 1891, p. 379.

A pair taken *in copulâ* at Biskra had the following measurements:—♂, snout to vent 124 millim.; ♀, 96.

4. *BUFO VULGARIS*, Laurenti; Boulenger, *loc. cit.* p. 159.  
1 specimen, Algiers.

### Family III. HYLIDÆ.

#### Genus *HYLA*, Laurenti.

5. *HYLA ARBOREA*, Linnæus; Boulenger, *loc. cit.* p. 159.  
Var. *MERIDIONALIS*, Boettger.

1 ♀, Tlemçen; 1 ♂ & 1 ♀, Hammam Meskoutine, Province of Constantine.

### Family IV. DISCOGLOSSIDÆ.

#### Genus *DISCOGLOSSUS*, Otth.

6. *DISCOGLOSSUS PICTUS*, Otth; Boulenger, *loc. cit.* p. 160.

2 ♂, Tlemçen, Province of Oran; 6, Hammam R'irha, Province of Algiers; 2, Algiers.

The condition of the tympanum in these specimens varies considerably, being distinct in some and wholly invisible in others. It thus supports M. Lataste's opinion, with which Mr. Boulenger agrees, that there is only one species of *Discoglossus*.

### DESCRIPTION OF PLATE I.

Fig. 1. *Chalcides boulengeri*, nat. size.

Fig. 2. View of the upper surface of the head, twice nat. size.

Fig. 3. Side view of the head, twice nat. size.

Fig. 4. View of the upper surface of the head of *C. sepoïdes*, Audouin, twice nat. size.

Fig. 5. Side view of the head of the same species, twice nat. size.

Fig. 6. Upper surface of the head of *Vipera lebetina*, Linnæus, var. *deserti*, nat. size.

Fig. 7. Side view of the head of the same, nat. size.

## 2. On the Myriopoda and Arachnida collected by Dr. Anderson in Algeria and Tunisia. By R. I. Pocock.

[Received January 11, 1892.]

The Myriopoda collected by Dr. Anderson during his stay in Algeria and Tunisia in the winter of 1890 and 1891 are referable to 21 species, one of which appears to be new. This, which I call *Brachydesmus insculptus*, seems to be very nearly related to a species that was described two years ago by Dr. Latzel from the Azores. This fact is of interest, inasmuch as it affords another link to the chain of affinity between the fauna of these islands and that of the Mediterranean district of the Palæarctic region.

The rest of the species are principally remarkable for the light

that they throw upon the synonymy of old-established but little-known species.

The only circumstance to be noticed here with respect to the Arachnida is the vast amount of variation shown by the sexes and young of the Scorpion, *Prionurus australis*.

### ARACHNIDA.

The only species of this group obtained by Dr. Anderson are the following:—*Galeodes olivieri*, Simon, *Prionurus australis* (Linn.), *Buthus europæus* (Linn.), and *Buthus leptochelys* (Ehrb.). All of them are well-known N.-African forms, but I am not aware that *B. leptochelys* has been ere this recorded so far to the West.

The species were obtained at the following localities:—*Galeodes olivieri* between Biskra and Tuggurt; *Prionurus australis*, Duirat, Biskra, Tuggurt; *Buthus europæus*, Algiers, Hammam Meskoutine, Hammam R'irha; *Buthus leptochelys*, Biskra.

### CHILOPODA.

#### Fam. SCUTIGERIDÆ.

SCUTIGERA COLEOPTRATA (Linn.).

Hammam R'irha and Algiers.

Common in Madeira and in the southern parts of Europe.

#### Fam. LITHOBIIDÆ.

LITHOBIUS IMPRESSUS, C. Koch.

Kherrata, Constantine, Tunis, Hammam R'irha, Algiers.

Originally described from Algeria, but abundant in many parts of Italy.

LITHOBIUS CASTANEUS, Newport.

Algiers, Hammam Meskoutine, Hammam R'irha, Kherrata, Constantine.

This species was redescribed as *eximius* by Meinert; see Pocock, Ann. Mus. Genov. (2) ix. p. 63, 1890. It occurs also in S. Europe.

#### Fam. SCOLOPENDRIDÆ.

SCOLOPENDRA MORSITANS, Linn.

The North-African form of the cosmopolitan *S. morsitans* was described by Koch as *S. scopoliana* and by Newport as *S. algerina*. For the synonymy of *S. scopoliana* see Pocock, Ann. Mag. Nat. Hist. ser. 6, vii. pp. 51, 52.

SCOLOPENDRA ORANIENSIS, Lucas.

*S. oraniensis*, Lucas, Rev. Zool. 1846, p. 237; id. Expl. Sci. de l'Alg., Anim. Art. p. 344.

*S. dalmatica*, C. Koch, 1847, and other authors.

Hammam R'irha, Tunis.

At these localities Dr. Anderson obtained three examples of

a species of *Scolopendra*, which agree closely with Lucas's figure and description of *S. oraniensis*, and at the same time are not specifically distinguishable from the S.-European *S. dalmatica*; Lucas's name must consequently supersede that of Koch.

The two specimens captured at Hammam R'irha are smaller and very dark-coloured, being an exceedingly deep green. The Tunisian example, on the contrary, is very much paler and considerably larger.

CUPIPES GERVAISIANUS (Koch).

Hammam Meskoutine.

It is needless to repeat here the involved synonymy of this species. It may be found at length in my paper in the *Ann. Mag. Nat. Hist.* ser. 6, vii. pp. 51-53.

This species also occurs in S. Europe.

OTOSTIGMA SPINICAUDA (Newport).

*Branchiostoma spinicauda*, Newp. *Tr. Linn. Soc.* xix. p. 412.

*Otostigma deserti*, Meinert, *Vid. Medd. Nat. Forening*, 1886, p. 121.

Biskra.

The above-given synonymy was published by me before it had been my good fortune to examine a specimen of this species from the locality where the types of *O. deserti* were obtained. Dr. Anderson, however, has supplied the missing link in the chain of evidence by procuring a specimen from Biskra. This example is undoubtedly co-specific with Newport's types of *B. spinicauda* and also with those that Meinert described as *O. deserti*.

This species is not known to occur in Europe.

CRYPTOPS ANOMOLANS, Newp.

Constantine.

This species is the *punctatus* of Koch and all authors; see my paper on the Chilopoda of Liguria, in the *Ann. Mus. Genov.* (2) ix. p. 68 (1890). It is probably also the same as the species Lucas described as *C. numidicus*; but to this last were assigned only 12 antennal segments.

Fam. GEOPHILIDÆ.

ORYA BARBARICA, Gervais.

Constantine, Kherrata, Hammam Meskoutine.

HIMANTARIUM RUGULOSUM, Koch.

Algiers.

HIMANTARIUM MEDITERRANEUM, Mein.

Constantine.

GEOPHILUS PUSILLUS, Mein.

Algiers.

## GEOPHILUS FERRUGINEUS, Koch.

Hammam Meskoutine.

## DIPLOPODA.

## Fam. GLOMERIDÆ.

## GLOMERIS FUSCO-MARMORATA, Lucas.

Algiers, Hammam R'irha.

This species appears at most to be but a variety of the S.-European *G. conspersa*.

## GLOMERIS FLAVO-MACULATA, Luc.

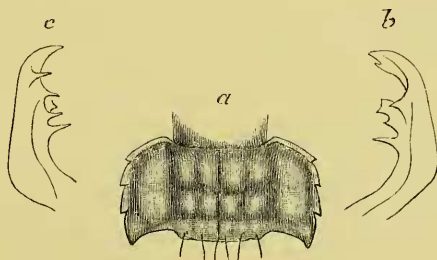
Hammam R'irha.

This species also is most probably but a variety of the European *G. connexa*.

## Fam. POLYDESMIDÆ.

## BRACHYDESMUS INSCULPTUS, sp. n.

*Colour* pale brown or ochraceous. Moderately robust. Antennæ much longer than the width of the body. The first tergite sub-



*a.* *Brachydesmus insculptus*, sp. n. ; 8th tergite from above.  
*b.* " " " " copulatory foot, external view.  
*c.* " " " " " " internal view.

carinate, marked with two transverse depressions, between which run two or three longitudinal grooves with an anterior row of 6 small tubercles, the posterior large tubercles very distinct; the rest of the tergites with the sculpturing very strongly marked, the grooves sharply defining the tubercles; the anterior angle of the keels obtuse but subdentate at the apex, the posterior angle acute and produced; the side margin of the pore-bearing keels tridentate, of the others bidentate (not including the anterior and posterior angles). Legs short and robust. Copulatory feet strong and falciform, narrower before the apex, which is curved; below the apex on the inside and on the outside there is a single process, and there are

three other processes and a membranous expansion on the posterior aspect of the appendage. Length up to 13 millim., width 1.6.

Closely allied to, if not identical with, *B. proximus* of Latzel from the Azores.

Hamam R'irha.

This is probably the species that Lucas records as *Polydesmus complanatus*.

**STRONGYLOSOMA GUERINII**, Gerv.

*Strongylosoma guerinii*, Gerv. Ann. Soc. Ent. Fr. iv. p. 686.

Hamam R'irha.

This species was originally described from Madeira, whence the British Museum has examples. It is widely distributed in the Atlantic Islands, occurrng both in Teneriffe and the Bermudas.

I suspect that this is the species which Lucas identified as *S. pallipes* (Oliv.).

Fam. IULIDÆ.

**IULUS FUSCO-UNILINEATUS**, Lucas.

Kherrata, Hamam R'irha, Constantine.

**IULUS DISTINCTUS**, Lucas.

Constantine.

The synonymy of these two species of *Iulus* requires reinvestigation.

Fam. POLYZONIDÆ.

**DOLISTENUS SAVII**, Fanz.

Hamam R'irha.

This interesting Millipede is a great rarity. It has been found in Italy, but is new to the African shore of the Mediterranean. The repugnatorial pores begin on the fifth somite.

3. On the Earthworms collected in Algeria and Tunisia by Dr. Anderson. By FRANK E. BEDDARD, M.A., Professor to the Society.

[Received January 5, 1892.]

As nothing appears to be known of the Earthworms of the northern part of the African Continent, excepting Egypt, I am very glad to have had the opportunity, afforded me by Dr. Anderson's kindness, of examining a small collection made by him during the spring of last year in Algeria and Tunisia.

Earthworms show in so very plain a manner the effect of barriers to dispersal in their distribution, that I had expected to find the Algerian forms identical with or closely allied to those of Europe. The Earthworm-fauna of Central and South Africa is evidently very

rich, though at present but little known ; but the Sahara has proved here, as it has in the case of other animals, to be a barrier preventing the northward range of these forms. Only in Egypt are there any genera found also in Tropical Africa ; the very remarkable genus *Siphonogaster* occurs in Egypt and in the neighbourhood of Lagos, W. Africa. But the banks of the Nile, or even the river itself (for many species of Earthworms can withstand a prolonged immersion in fresh water), have furnished, no doubt, the opportunity of migration.

Mr. Alvan Millson, Colonial Secretary at Lagos, kindly collected for me a number of Earthworms in Egypt ; all these species were members of the genera *Lumbricus* and *Allolobophora*.

Besides Levensen's paper upon *Siphonogaster* and *Digitibranchus* (= *Alma*) we do not possess, I believe, any further information upon the Oligochaeta of Egypt than that which has been given in the preceding sentence.

Dr. Anderson's collection contains examples of two recognizable species, *Allolobophora complanata* and *Microscolex modestus*. Besides these, there are two or three immature forms of the genus *Allolobophora* which are not old enough for identification.

#### ALLOLOBOPHORA COMPLANATA (Dugès).

*Lumbricus complanatus*, Dugès, Ann. Sci. Nat. t. viii. pp. 17, 22.

This species is a well-known South-European form, having been met with in S. France, Italy, Portugal, and the Balearic Islands. I now add Algeria to the list of localities whence it has been obtained. The principal information as to the structure of this species is to be found in Dugès's memoir upon the Earthworm, in Rosa's account of the Lumbricidæ of Piedmont<sup>1</sup>, and in a paper by myself devoted to this species<sup>2</sup>. In neither of two specimens belonging to Dr. Anderson which I dissected was there any trace of the peculiar diverticula of the spermathecæ which I described in the paper last referred to.

As neither Dugès nor Rosa observed anything of the kind, it is possible that the individual I described should be regarded as a variety of the more typical form, the occurrence of which in Algeria I here record.

#### MICROSCOLEX ALGERIENSIS, n. sp.

There is only a single specimen of this species, which I investigated by means of longitudinal sections of the head end. The structure of the posterior segments was examined by mounting portions of the body in glycerine after having been cut open.

It is a small worm, measuring only an inch or so in length and composed of 80-90 segments. Being curled into a circle in the preservation, I am not able to give exact measurements, which are, however, not of very great importance.

<sup>1</sup> 'I Lumbricidi del Piémonte,' Turin, 1885.

<sup>2</sup> "Observations on the Structure of *Lumbricus complanatus*, Dug.," Proc. Roy. Soc. Edinb. xiii. p. 451.

The *prostomium* is large, being larger than the diameter of the first segment.

The *setæ* are disposed precisely as in *Microscoclex modestus*: that is to say, the *setæ* are not in closely approximated pairs, and the distance between seta 1 and seta 2 is less than that between setæ 3 and 4. The diagram given by Rosa of the *setæ* of *M. modestus* would express, so far as I can make out, the relations of the *setæ* in *M. algeriensis* exactly. There is nothing noteworthy in the form of the *setæ*. As in other Earthworms, the four *setæ* of each side of the body in each segment are connected by muscular strands which favours, it may be supposed, their simultaneous movement. This muscle in *Microscoclex* is easily overlooked, owing to its great thinness; it is not more than two fibres thick.

The *clitellum* is complete (forming, that is, a ring) and occupies segments xiv.–xvii. with a part of xiii. Its structure is like that of other Earthworms.

I could find no *dorsal pores*.

The *alimentary tract* is peculiar from the absence of a gizzard, of which traces appear to exist in other species of *Microscoclex*; for in *M. dubius* Rosa speaks of “un ventriglio rudimentale, piatto, in forma di coppa;” as to the only other known form, *Microscoclex modestus*, Rosa found that “il ventriglio esiste, ma così rudimentale da non potersene veder le traccie che nelle sezioni.” It is not always possible to detect the presence or absence of a gizzard without having recourse to section cutting. *Pontodrilus*, for example, is stated by Perrier to be without this special region of the *œsophagus*; but it is obviously present, though certainly much reduced, when the anterior region of the worm's body is examined by means of sections.

The *pharynx* ends in the third or fourth segment, and, as in other Earthworms, there are masses of glands upon the dorsal surface. These glands, which seem to represent a part of the system of septal glands in the lower Oligochæta, are not confined, in *Microscoclex algeriensis*, to the pharyngeal region of the alimentary tract; they extend back as far as the ninth segment, and therefore suggest more clearly the septal glands, with which they must surely be homologous. It is interesting to recall the fact that these glands occur also in *Ocnerodrilus*, which is another form near to the border line between the terricolous and limicolous Oligochæta, though nearer to the latter than is *Microscoclex*.

The *œsophagus* of *Microscoclex algeriensis* is divided into two regions; up to the end of segment vii. it is not markedly vascular, and the living epithelium is composed of more densely packed cells, which gives it a more deeply stained appearance under the microscope. The rest of the *œsophagus* has a richly-developed vascular network, and the epithelium appears to have a looser texture, the cells being less tightly packed; from this circumstance the posterior region of the *œsophagus* looks paler in sections. In the xvth segment the *œsophagus* becomes much narrower and then suddenly widens into the intestine which commences in the xvith segment.



The *intestine* has no typhlosole. The *intersegmental septa* are first visible after segment v. Those separating segments vii./viii., viii./ix., ix./x., x./xi., xi./xii., xii./xiii. are thicker than the following ones. Their insertion ventrally does not correspond with the intersegmental furrows, and this absence of correspondence is found also further back. It is by no means unknown in other Earthworms, and is, as a rule, limited to the anterior segments. *Microscolex algeriensis* has *nephridia* in all segments of the body commencing with the second. They are paired and open in front of and a little to the outside of the third seta. In dissection the nephridia are seen to lie between the second and third setæ on each side. There is a long muscular end-sac, which in section was invariably much crumpled owing to the thinness of its walls.

The series of nephridia in this species is more complete than in either of the other two species of the genus. It is important to notice that after the xviii segment the nephridia have a thickish coating of peritoneal cells. A difference of this kind often exist between the anterior and posterior nephridia in Earthworms, though nothing of the kind has been mentioned by Rosa in this particular genus.

With regard to the *vascular system* the most noteworthy point is the presence of three pairs of "hearts" in segments x., xi., and xii. There are pericæsoophageal vessels in some of the segments anterior to the xth, but these are not so well developed as those of the three segments mentioned. The hearts of segment xii. are by far the stoutest; their diameter is at least twice that of the preceding vessels, which are themselves of rather greater calibre than those of segment x. There is no sub-nervian vessel.

The *brain* is situated in the second segment, near to its posterior boundary; the forward position of the brain is of interest.

The *generative system* conforms to the general type met with among the Cryptodrilidæ. The testes are two pairs in segments x. and xi. Opposite to them are the not remarkably large funnels of the vasa deferentia; the testes of segment xi. are partly attached to the vas deferens just where it perforates the segment. The sperm-sacs are in segments xi. and xii.; they involve neither the testes nor the funnels. The two vasa deferentia of each side of the body remain perfectly distinct from each other up to their point of opening on to the exterior. The two tubes run side by side in a rather sinuous course, just below the peritoneum. In the xviii segment are a pair of "prostates," or, as I prefer to call them, atria. They are of the tubular form, and, as usual, are separated into a glandular and a muscular portion. The minute structure of this tube is precisely as in *Acanthodrilus*, *Pontodrilus*, &c. The atria are not long, and are entirely contained within the xviii segment, instead of being, as is frequently the case, prolonged into adjoining segments. The exact mode in which the vasa deferentia open, I have not been able to ascertain. In any case the two tubes, still retaining their individuality, bore their way into the body-wall a little in front of the point where the atrium opens; they then pass

beyond the atrium, and, I imagine, open just at the atriopore, as in *Ocneroдрilas*; but I am not certain about this. The atriopore is situated just to the outside of the ventralmost seta, which is not modified in any way; there are, in fact, no penial setæ, such as occur in the other two species of the genus.

The ovaries are in segment xiii. The oviducts open by funnels into this segment opposite to the ovaries, and open to the exterior on segment xiv. Receptacula ovarum are present, and are of considerable size relatively to the sperm-sacs.

There is a single pair of spermatothecæ present in segment ix.; each opens on to the exterior just behind the septum which separates this segment from the one in front and in a line with the ventral seta. Each spermatotheca consists of an oval pouch and a single narrow diverticulum opening into it in front.

#### MICROSCOLEX POULTONI, n. sp.

It may be permissible to append to this paper the description of a fourth species of *Microscolex*, of which a number of examples were kindly collected for me in Madeira by Mr. E. B. Poulton, F.R.S. They measure, when preserved, about an inch in length; they are of a brown colour, the clitellum being orange.

The *clitellum* is variable in extent, always, however, including segments xiv.-xvi.; in some specimens a part or the whole of segments xiii. and xvii. belonged also to the clitellum. Segments xiv.-xvi. were much broader than those immediately adjoining.

The *setæ* are disposed as in other species of the genus; but upon the clitellum the ventral pair of setæ of each side get very much closer together.

On segments xiv., xv., xvi., and xviii. the ventral setæ (see drawing, fig. 1, p. 33) are separated from each other by a distance which is less than half that which separates the corresponding setæ of segment x. From segment xix. backwards, and from segment xiii. forwards, the distance between the two ventral setæ of each side gradually increases.

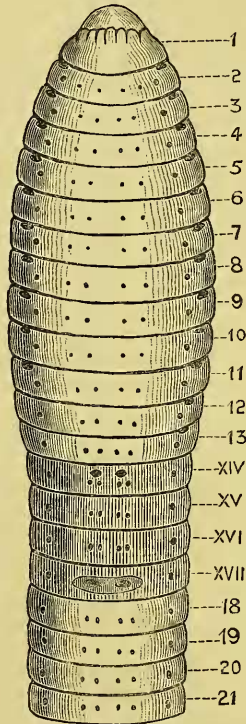
The *male pores* are upon segment xvii.; each is situated upon an oval elevation, and through the aperture itself protrudes a single penial seta, which corresponds in position to the innermost seta of the ventral pair. The penial setæ of this *Microscolex* are (see fig. 2, p. 34) long, slightly curved, and not ornamented at the free extremity; when examined under a high power they show a faint transverse striation which marks the successive deposits of chitinous matter in the formation of the seta. There is a slight notch some little way in front of the distal extremity.

The *pharynx* occupies the first 5 segments or so; there is not a great development of glands upon its upper surface, and there is no continuation of these septal glands into the œsophageal segments, such as occurs in *Microscolex algeriensis*. The *œsophagus* immediately following the pharynx has, perhaps, slightly thicker walls than the hinder part; but there is nothing that can be fairly termed a gizzard.

The epithelial lining of the *oesophagus* is folded; this folding is perhaps more marked in segments xi., xii., and xiii. In segment xv. the *oesophagus* forms a globular dilatation, the walls of which are perfectly smooth without any folding; a very narrow aperture puts this into communication with the intestine which commences in the xvith segment.

In the terminal dilatation of the *oesophagus*, the epithelium

Fig. 1.



Anterior segments of *Microscolex poultoni* from the ventral surface.

The segments are numbered consecutively, those of the clitellum in Roman numerals, the others in Arabic numerals. On the anterior thirteen segments the nephridiopores are shown in front of the dorsal setæ. The oviducal pores are on segment xiv., the male pores on segment xvii.

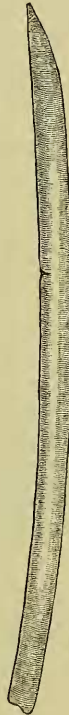
gradually gets higher until its cells are identical in appearance with the tall narrow columnar cells which form the lining membrane of the intestine. Just at the opening of the *oesophagus* into the intestine, the cilia are very long and conspicuous; but the *oesophageal* epithelium is also ciliated throughout the xvth segment; in front of

this point I could not be certain of the presence of cilia. The *intestine* has no typhlosole.

The *brain* is situated further back in the body than in the last species; it lies towards the posterior boundary of segment iii.

The first *intersegmental septum* separates segments v./vi.; the septa separating segments vi./vii., vii./viii., viii./ix., ix./x., x./xi., xi./xii., xii./xiii., xiii./xiv., xiv./xv. are shorter than those which follow, but there is not a very great increase of thickness in their

Fig. 2.



Penial seta of *Microscollex poultoni*.

muscular layers—not so much, for instance, as in the last species. The ventral insertion of the anterior septa does not coincide with the intersegmental furrows.

The *nephridia* commence in segment iii. Their structure appears to be identical with that of the last described species. The first

pair, although they lie chiefly in segment iii. in front of the nerve-cord, open on to the exterior between segments i. and ii. On account of the large terminal end sac, which is prolonged on both sides of the aperture, and may be thus said to have a cæcum, it is always easy to make out the external aperture. I am therefore able to be confident about this point, which distinguishes the present species from both *Microscolex dubius* and *Microscolex modestus*, and allies it with *Microscolex algeriensis*. The external pore is to the inside, and slightly in front, of seta 3<sup>1</sup>.

The three strongly developed hearts of segments x., xi., xii. are present in *Microscolex poultoni*.

The generative organs show no great differences from those of other species. As in *M. algeriensis*, the true vasa deferentia retain their independence until close to the external aperture; they pass a short way beyond the muscular duct of the atrium, and unite to form one tube, which is surrounded with a thick layer of muscular fibres chiefly circular; this tube is quite indistinguishable in its structural characters from the muscular duct of the atrium; in a section the two tubes cannot be distinguished except by their position. In the thickness of the body-wall, and near to the external pore, they unite. The penial setæ have already been referred to.

The sperm-sacs are racemose, and occupy the same position as in *Microscolex algeriensis* and all the other species of the genus.

The funnels of the sperm-ducts are larger and more folded than in that species.

I could find neither spermathecae nor egg-sacs.

This latter character connects *Microscolex poultoni* with *M. dubius*, but it is quite clear from the above description that the species described here is perfectly distinct from *M. dubius*.

The principal differences are:—

- (1) The fusion of vasa deferentia in *M. dubius* to form one tube, which opens into the muscular tube of its prostate.
- (2) The commencement of the nephridia in the vth segment in *M. dubius*.
- (3) The absence of any alteration in the position of the seta on the clitellum in *M. dubius*.

It shows much the same resemblances to *M. dubius* that *M. algeriensis* shows to *M. modestus*. If Dr. Rosa were not so careful a worker as he has proved himself, I should be almost inclined to suspect an identity.

The genus *Microscolex* has been investigated by Rosa and Fletcher. It was first met with in Italy by Dr. Rosa<sup>2</sup>, who, in a later

<sup>1</sup> The ventralmost seta on each side is seta 1, the next seta 2, &c.

<sup>2</sup> "*Microscolex modestus*, n. gen., n. sp.," Boll. Mus. Zool. Torino, vol. ii. no. 19 (3 cuts).

paper<sup>1</sup>, surmised that Fletcher's<sup>2</sup> *Eudrilus dubius* would prove to be a *Microscolex*. This suggestion was later<sup>3</sup> shown to be correct by the description of a species of *Microscolex* evidently identical with *Eudrilus dubius* from the Argentine. I received myself, some time since, a number of examples of a *Microscolex* from Madeira, through the kindness of Mr. E. B. Poulton, F.R.S., which are described above. The existing knowledge of the distribution of the genus is as follows:—

1. *Microscolex modestus*. Italy, Argentina.
2. *Microscolex dubius*. Australia, Argentina.
3. *Microscolex algeriensis*. Algiers.
4. *Microscolex poultoni*. Madeira.

The characters of *M. algeriensis* evidently necessitate a revision of Rosa's generic definition given on p. 511 (3 of sep. copy) of his memoir on the Argentine Earthworms.

The following points are, I think, sufficient to distinguish this genus from any other genera among the Cryptodrilidæ.

#### Genus MICROSCOLEX, Rosa.

*Microscolex*, Rosa, Boll. Mus. Zool. Torino, vol. ii. no. 19.

*Setæ* 8 per segment, distant. *Clitellum* on segments xiii., xiv., xv., xvi., xvii., complete.  $\text{♂}$  pores on xvii. No dorsal pores. *Subnerve* vessel absent. *Nephridia* paired, present in genital segments. *Hearts*, 3 pairs in segments x., xi., xii. *Gizzard* absent or rudimentary. *Intestine* without typhlosole. *Atria* tubular, with or without penial setæ. *Spermatheca* (if present) one pair in ix., with diverticulum.

The affinities of the genus have been discussed by Rosa, who compares *Microscolex* with *Photodrilus* and *Pontodrilus*. I may point out that the absence of penial setæ in *Microscolex algeriensis* lessens the distance between the genus and *Pontodrilus*.

The species which I describe here is quite clearly distinct from the two others. The table (on p. 37) indicates the principal resemblances and differences between the four species *Microscolex dubius*, *M. modestus*, *M. algeriensis*, and *M. poultoni*.

<sup>1</sup> "Sui generi *Pontodrilus*, *Microscolex*, e *Photodrilus*," l. c. vol. iii. no. 39.

<sup>2</sup> "Notes on Australian Earthworms," pt. iii., Proc. Linn. Soc. N.S.W. vol. ii. ser. 2.

<sup>3</sup> "I terricoli Argentini raccolti dal Dott. Carlo Spegazzini," Ann. Mus. Civ. Genova, vol. ix. ser. 2.

	<i>M. dubius.</i>	<i>M. modestus.</i>	<i>M. algeriensis.</i>	<i>M. pouttoni.</i>
<i>Citellum</i> .....	On segments 13-17.	13-17.	13-17.	13-16 <sup>1</sup> (17).
<i>Nepheridia</i> .....	Commence in 5.	Commence in 4.	Commence in 2.	Commence in 2.
<i>Gizzard</i> .....	Rudimentary.	Rudimentary.	Absent.	Absent.
<i>Spermatheca</i> .....	Absent.	One pair.	One pair.	Absent.
<i>Vasa deferentia</i> .....	Unite to form one tube on each side, which opens into muscular tube of atrium.	?	Remain separate, and open into atrial duct just before (?) external pore.	Remain separate up to atria, when they fuse and become invested in a muscular sheath; the tube thus formed unites with atrial tube just before external aperture.
<i>Penial setæ</i> .....	Present.	Present.	Absent.	Absent.
<i>Receptacula ovarium</i> .....	Absent?	Present.	Present.	Absent.

<sup>1</sup> The line above or below the number indicates that a part only of the segment in question is included in the citellum.

4. On the Milk-Dentition of *Procavia (Hyrax) capensis* and of the Rabbit (*Lepus cuniculus*), with Remarks on the Relation of the Milk and Permanent Dentitions of the Mammalia. By M. F. WOODWARD, Demonstrator of Zoology, Royal College of Science, London<sup>1</sup>.

[Received January 5, 1892.]

(Plate II.) †

### I. *Historical.*

The dentition of such an interesting Mammal as *Hyrax*, as may readily be supposed, has been carefully studied by many zoologists, who, probably owing to the fact that many of them based their descriptions upon one or two *dried* skulls only, have given the most varied interpretations of the teeth. As a result we find a great discrepancy in the dental formulæ given in their various monographs and in the text-books compiled from them.

Most of the earlier authorities agreed as to the absence of canines, but disagreed as to the total number of teeth present (viz. 34 or 36) and as to the number of true molars and incisors, the most commonly accepted formula being  $i. \frac{1}{2}, c. \frac{0}{0}, pm. \frac{4}{4}, m. \frac{3}{3} = 34$ . Many observers, however, state that there are present at one time 8 cheek-teeth above, and as they regard the extra tooth as a molar, they formulate the molars as 3-4 above and 3 below. More rarely we find the incisors described as being  $\frac{2}{2}$ ; and lastly, two observers<sup>2</sup> have described a pair of canines as being present in the upper jaw.

All are agreed as to the number of teeth present in the lower jaw of the adult, viz. 9; but there is much disagreement as to the total number of teeth present in the upper jaw (viz. 8-9), and also as to the homologies of the individual teeth and sets of teeth.

Most state emphatically that there are no canines present in either jaw. Cuvier, however, asserted (4) that there was a pair of small canines present in the upper jaw of the young animal, and he regarded them as the accessory teeth of Pallas (25), but this opinion he afterwards retracted (5).

It remained for Lataste (19) to be the first to show definitely that there is present in the upper jaw of all young specimens a pair of small canines; he has shown that these are shed early in life and that they rarely persist till the completion of the second dentition. He bases his conclusions on the shape and position of these teeth together with the characters of the 2nd maxillary tooth (1st premolar) as exemplified in a very large series of skulls of all ages, and finally on a comparison with the teeth of the near allies

<sup>1</sup> Communicated by Prof. Howes.

<sup>2</sup> Cuvier (4) and Lataste (19).







of *Hyrax* (viz., the Rhinoceros, Tapir, and Horse), which never possess more than seven cheek-teeth (molars and premolars), while showing all stages in the development of the canine. He has succeeded in showing that many of the earlier observers figured and described these canines, mistaking them for the 1st premolars, on account of the resemblance between the latter in the second dentition and the milk-canines. But although the 1st premolar in the second dentition is much reduced and has sometimes only one fang, it is situated some distance from the premaxillo-maxillary suture, and in the first dentition has a large crushing crown and is two-fanged. He considers that the canines, together with the 1st premolar, are undergoing suppression, and that as a consequence of this the former teeth have lost their more typical characters.

With the exception of Giebel (12, 13) and Brandt (2), all observers state that there is only a single pair of incisors in the upper jaw. These two authorities, however, have described in the young animal a second small and posterior incisor, which is early shed and is situated in the premaxilla behind the large first milk-incisor. This tooth is not to be confounded with the milk-incisor No. 1, which is a large tooth situated between the two permanent ones, as figured by Cuvier (5) and Blainville (1); it undoubtedly represents a 2nd upper incisor, although in all probability it is only a milk-tooth, always present in the fœtus, but seldom, I believe, persistent after birth. Giebel and Brandt were of opinion that Cuvier mistook these small incisors for canines; but as the former are situated in the gum which covers the premaxilla, while the latter lie well within the maxilla, their position implies that he did not understand what is generally supposed to be the fundamental distinction of the canine, viz., that it is typically a single-fanged pointed tooth implanted in the maxilla just behind the premaxillo-maxillary suture.

It has been already noted that no observer has seen more than 9 teeth in the upper jaw; none of those who describe the presence of a canine make the slightest allusion to the presence of 2 upper incisors, and further perusal of the descriptions alluded to shows that those who described the 2nd incisor almost certainly were dealing with Cuvier's canine. This is probably due to the fact that the earlier observers do not seem to have had access to some of the monographs of their predecessors, but it does not excuse a modern European writer like Lataste having apparently failed to consult a classical work like Brandt's Monograph on *Hyrax*, or a standard one such as Broun's 'Thier-Reich.'

## II. Results of the present Investigation.

The material which I have examined was kindly placed at my disposal by Prof. Howes, and consisted of 5 fœtal examples of *Hyrax capensis* preserved in spirit, being the specimens the placenta of which was described by Prof. Huxley before this Society in 1863<sup>1</sup>. The

<sup>1</sup> P. Z. S. 1863, p. 655.

specimens measure about 12·5 centim. long and only show a few of the larger hairs.

The method adopted for the examination of the teeth is, I believe, the only reliable one (if employed in connexion with serial sections) by which the true relations of developing teeth in a young animal can be made out.

The skin was carefully removed from the sides of the jaw, and the whole jaw, with gum covering it intact, was placed in absolute alcohol and thoroughly dehydrated; it was then clarified in clove-oil, and either examined in that medium or mounted in Canada balsam. By this treatment the teeth are seen through the bones in their natural position in relation to one another and to the surrounding parts, whereas by dissection they are apt to be displaced. Further, some teeth when undergoing suppression are so minute as to be practically invisible to the unaided eye, so that under manipulation by ordinary dissection they would be entirely overlooked. On the other hand, if exclusively examined in serial sections it is doubtful if their exact position and relationships could be determined with absolute accuracy. This is notably the case with the anterior milk-incisors of the Rabbit (the upper of which measures only ·13 millim. in length) described by Huxley (16) (figs. 4 & 5,  $di^1$ ), and which were discovered by this method, Huxley being, I believe, the first to apply it to the examination of tooth relationships.

It is worthy of note that the method does not prevent one afterwards sectionizing the jaw; in fact, it is best to examine the jaw first in this way in order to see exactly what teeth are present and what are their positions, as it then becomes much easier to interpret the appearances presented by serial sections.

A microscopic examination of the clarified jaw (Plate II. fig. 1) shows that there are present at this age 8 teeth in the upper jaw and 7 in the lower one.

Those of the upper jaw may be divided into premaxillary and maxillary teeth, there being 3 of the former (fig. 1,  $di^1$ ,  $di^2$ ,  $di^3$ ) and 5 of the latter (fig. 1,  $c$ , I., II., III., IV.). The first premaxillary tooth is very large and roughly conical; it lies completely buried in the bone and, from a comparison of a series of skulls, it becomes evident that it is the milk predecessor of the large permanent incisor; it attains a considerable size and persists for a long period after birth. As the fetus was very young, the permanent incisor had not yet been differentiated.

The two posterior premaxillary teeth (fig. 1,  $di^2$ ,  $di^3$ ) are very small, and variable; both were present in three out of six preparations, one only was present in two, and both were wanting in the other.

In two cases they were very fully developed (fig. 2,  $di^2$ ,  $di^3$ ), although small, and the anterior one was in all cases the largest. In the specimen figured the measurement of the anterior one ( $di^2$ ) is ·62 millim. long  $\times$  ·35 millim., that of the posterior one ( $di^3$ ) being ·31 millim. long  $\times$  ·19 millim.

The anterior one presents a small conical crown composed of a distinct layer of enamel and dentine (fig. 2,  $di^2$ ,  $c$ , and  $d$ ), a well-

marked cervix, and a simple single fang, slightly constricted at its base. The smaller posterior one (fig. 2,  $di^2$ ) is much simpler and not so much calcified, and although it had no distinct fang yet the pulp-cavity was already partially constricted.

In position the two teeth lie close to the surface of the gum, and though they overlap the premaxilla they are really external to it, alveoli being undeveloped<sup>1</sup>. The anterior one lies just in front of the premaxillo-maxillary suture (fig. 1, *ms.*), while the smaller posterior one lies just between the two bones, but under cover of the premaxilla and quite in front of the maxilla.

In the two cases where only one of these teeth was developed, it was obviously the anterior one from its position; it was larger and rounder than the one figured (figs. 1 & 2,  $di^2$ ), and was evidently younger and still undergoing development.

The maxillary series of teeth are 5 in number: the first (fig. 1, *c*), a small uncalcified tooth-germ, which lies close to the anterior border of the maxilla, is obviously the canine; while the four remaining ones (fig. 1, I., II., III., IV.) represent the deciduous premolars and have not yet developed their fangs. They are simple calcified cappings of the pulp, the only points of interest about them being their proximity to the premaxillo-maxillary suture and the manner in which the first one is displaced so as to partially overlie the second.

Examining the teeth of the upper jaw as an entire series, we see at once that the most fully formed ones are the two small posterior premaxillary teeth ( $di^2$ ,  $di^3$ ). Unlike the remaining teeth, all of which lie deep down in the bone, these small ones are situated close to the surface of the gum, so that they must evidently cut the gum first if not absorbed.

A tooth whose crown is once calcified does not, as a rule, increase in transverse diameter, because the dentine composing the greater part of it is deposited from within outwardly; so that when dealing with a tooth possessing well-marked layers of dentine and enamel, one is fairly safe in saying that the crown will not enlarge much transversely. When the fang is formed and partially constricted at its base, one is justified in regarding that tooth as being fully formed, as the constriction of the pulp-cavity only takes place after the completion of the tooth.

The small teeth (fig. 2,  $di^2$ ,  $di^3$ ), in possessing the above characters, may be safely regarded as having attained their full size and being ready to cut the gum.

We have now to determine the homologies of these teeth. As we have seen, they are situated in the premaxilla behind the large incisor and immediately in front of the canine. The only teeth they can represent are the 2nd and 3rd incisors; so that the large incisor is thus proved from its position to be the first or anterior one. From the earlier development and small size of the 2nd and 3rd

<sup>1</sup> Jaeger (JB. nat. Ver. Würzb. 1860, xvi.) regards Cuvier's "*trous incisifs*" as the remainder of a deciduous 2nd incisor; but as the 2nd incisor very rarely persists and is generally external to the premaxilla, it is improbable that this depression, which is fairly constant, can represent its alveolus.

incisors it is highly improbable that they could persist after birth, whence we may reasonably look upon them as destined to be in all probability either absorbed or shed *in utero*.

Giebel and Brandt, as already mentioned, have described two incisors on either side of the upper jaw of young animals, and it seems, therefore, probable that the 2nd incisor may persist occasionally, especially as in two of my preparations, where only one of these teeth was present, the second incisor had undergone an increase in size, although it had not yet developed a fang; in fact, it was much more in the condition of the other milk-teeth, being more normally developed. It will be observed from this that there is nothing which will justify the unqualified assertion of Giebel and others before alluded to, that two upper incisors normally exist in the permanent dentition; for these small teeth never, I believe, persist till the permanent teeth appear; although they are only represented in one dentition, I incline to the belief that they should be regarded as milk-teeth.

In the lower jaw (Plate II. fig. 1), in addition to the 2 typical incisors and 4 premolars, we find on either side a small well-developed tooth (fig. 1, *c*) situated between the incisors and the first premolar. It lies close to the surface of the gum and is intermediate in size between the two vestigial upper incisors, measuring .4 millim. long  $\times$  .3 millim. wide, and is correspondingly well developed (fig. 2, *c*). It possesses well-marked enamel and dentine layers to the crown and a small simple fang. Like the small teeth in the upper jaw, its parts are all fully developed; but it is so small that, as in the case of the 3rd upper incisor, it has never before been observed. It certainly never persists after birth, even if it ever cuts the gum at all.

When the jaws are closed, this tooth is situated just between the upper canine and the third upper incisor, a position which suggests that it is the lower canine; but it is so close to the lower incisor that it might very well be the missing tooth of that series.

When, however, we note the order of suppression going on in the upper jaw, we find that while the two posterior incisors rarely persist, the canine is occasionally present even in the second dentition; this suggests that the latter is not so fully reduced as the incisor, wherefore we might, by analogy, fairly expect to see the canine more pronounced in the lower jaw. Further, recent observers<sup>1</sup> find in the Rhinoceros, one of the immediate allies of *Hyrax*, where only one of the anterior series of mandibular non-cheek teeth remains, that that is in all probability the canine and not an incisor.

From argument by analogy, I am therefore inclined to regard this small disappearing tooth as the lower canine, the 3rd and posterior incisor being apparently completely disappeared.

From the foregoing it may safely be concluded not only that the canines have, in *Hyrax*, ceased to have any functional importance, but that the incisors are being reduced in number by the suppression of the posterior ones.

In the permanent dentition the first premolars, both above and

<sup>1</sup> Lydekker, in Flower & Lydekker (9).

below, are much reduced (though well developed as milk-teeth), often bearing but a single fang, and are early shed.

It appears to be generally the rule amongst herbivorous animals that there is a suppression of the anterior teeth of the maxillary series, often accompanied by a reduction in number of the incisors and an increase in size of the remaining teeth. From this it would seem probable that *Hyrax*, in which the food and habits are very similar to those of the Rodentia and herbivorous mammals, would find it more serviceable to possess one or two pairs of large cutting incisors than three smaller ones; and the very early development and large size of the anterior incisors and of the large grinding premolars becomes readily intelligible upon this hypothesis.

If the jaws of the fœtus be examined in relation to the entire milk-dentition and to the rest of the skull, they will be seen to be relatively very small. Comparison of a series of skulls shows that the elongation of the jaws is attained very late, and that above it mainly involves the premaxillary and anterior maxillary regions. The conditions are such that in the young animal the jaws are uncomfortably crowded with teeth; this is especially noticeable in regard to the position of the first premolars (fig. 1, 1.) and in the vestigial condition of the 2nd and 3rd upper incisors and of both canines.

The clue to the ultimate suppression of the hinder incisors and the lower canine, and to the vestigial nature of the upper canine and both first premolars in the second dentition, appears to me to lie in the consideration of the above facts.

The large size and early development of some of the teeth render it obvious that these would take up more than their proper share of space and nourishment in the already overcrowded jaw, and we accordingly find that some of the teeth, which were of least functional importance, become either stunted or entirely crowded out of the jaw before it elongates.

The premolars of the fœtus (fig. 1) extend forwards to the premaxillo-maxillary suture; and comparison with the adult shows that the diastemata possessed by the animal are more nearly the result of a secondary elongation of the jaws themselves than of the mere suppression of certain teeth.

### III. *General Considerations.*

It will be seen from the foregoing description that *Hyrax* possesses several teeth which are only represented in one dentition. The question then arises whether these are to be considered as belonging to the 1st or to the 2nd series, and the answer to it involves a brief consideration of the relations existing between the two dentitions in the class Mammalia.

Prof. Flower (6, 7, 8, 9), in his various contributions to the study of Mammalian odontology, has all along sought to show that mammals were primitively monophyodont, and that the original single set of teeth is represented in the permanent (successional) teeth of the Diphyodonts, the possession of a milk or first dentition being a

secondarily acquired character, developed comparatively late in the evolution of the class.

Detailed perusal of his writings shows these conclusions to be drawn to a large extent from the study of the Marsupialia and especially of *Thylacinus*; the solitary tooth shed by that animal he regards as the sole representative of the milk or first dentition of its higher allies (Eutheria), believing the rest of its teeth to represent the permanent or successional second dentition of the latter. At the same time (7. p. 2) he has pointed out (and laid great stress on the fact) that the milk-teeth of the Eutheria invariably show a more primitive pattern and shape than those of the permanent or second series which replace them. The latter are often highly specialized; while the former often (as is especially the case with the Ungulates) agree more or less closely with the permanent teeth of the extinct ancestors of the order.

He concludes that when one set of teeth only are present, as in the Cetacea, it is invariably the permanent or 2nd one, the milk or 1st set being either not developed or suppressed.

Arguing along the same lines, he considers that when a tooth such as the 1st premolar in many diphyodont mammals is only present in one dentition (even though in many cases it is very early lost), it must belong to the 2nd or permanent series.

Thomas (26, 27) has lately accepted Flower's views as to the relation of the two dentitions, and has added largely to our knowledge of the dentition of Marsupials, Edentates, and Monotremes. He shows conclusively that it is invariably the 4th premolar (not the 3rd as Flower thought) which is replaced by a vertical successor in the Marsupials, thus bringing the dentition of Marsupials and Placentals into more complete harmony; while among the Edentates he has proved the existence of a milk-dentition in *Orycteropus* (26).

More recently Kükenthal (18), in a preliminary account of some researches on the development of the Cetacean teeth, has sought to show that, exclusive of the Monotremes, there is no such thing as a monophyodont mammal. In all Cetacea (the typical monophyodonts) he finds that rudimentary successional teeth appear in connexion either with the more fully developed functional ones of the toothed-whales or with the functionless tooth-points of the Mysticeti. He argues from this that these supposed typical Monophyodonts are really modified Diphyodonts, and further that their functional or most fully developed teeth belong to the 1st or milk-dentition, and not, as Flower supposed, to the 2nd set. He also advances some reasons for believing that the homodont condition may be arrived at by a splitting up of the primitive complex teeth of an original heterodont type.

In the Marsupials<sup>1</sup>, from a careful examination of the developing

<sup>1</sup> Since the above was written Kükenthal has published (Anat. Anz. 1891, p. 658) the details of his work on *Didelphys*, giving figures of the rudimentary successional teeth in connexion with the incisors, premolars, and even molars, the last being thus shown in the Marsupials to belong to the 1st dentition. These observations I can confirm so far as the incisors and molars of *Didelphys* are concerned, but in *Trichosurus* I can find no trace of the teeth successional to the molars. This may be owing to the embryo being too young.



teeth of *Didelphys*, he claims to have found that, besides the successional tooth to the 4th premolar, there are present indications of the enamel organs of the successional teeth in connexion with all those which remain; showing that the adult dentition of the Marsupials, with the exception of the 4th premolar, corresponds with the 1st or milk-dentition of the Placentalia, and not, as Flower and Thomas have held, with the 2nd or permanent one.

From these and other considerations he argues that the two dentitions among mammals are much more constant than has generally been supposed, and that they are probably of equal value—being developed side by side in the jaw from a common enamel ridge; and he further points out that while the 1st dentition attains its maximum development in the Marsupials and Cetacea, as we ascend in the mammalian series it diminishes in importance, so much so that in many animals (*e. g.* the Seals) it becomes quite rudimentary, while in others (*i. e.* Rodents) it possibly disappears altogether.

Should further enquiry substantiate Kükenthal's deductions that all mammals develop representatives of both sets of teeth, the advisability of retaining the terms Monophyodont and Diphyodont will have to be considered.

The facts to which I have herein drawn attention (above, pp. 40–42), taken in conjunction with Kükenthal's assertions just alluded to, show that with regard to teeth present in one dentition only, it is impossible to say for certain, upon mere examination of the dried skull, to which set they belong, and even comparative anatomy does not help us much (as in the case of the 1st premolar of Ungulates). We must rely entirely upon the study of development, and must base our determination upon the examination of a series of foetal jaws.

In view of this I am of opinion that we shall sooner or later find in the rest of the Edentates, the Sirenia, and probably in some Marsupials, that vestigial milk or rudimentary successional teeth, which probably never cut the gum, are almost certain to be present in some form or other—either as calcified structures or simply as enamel organs.

Should there be found teeth in the foetus showing no signs either of duplication or replacement by vertical successors, there will be good reasons for regarding them as belonging to the milk or first dentition, as this is invariably developed first in time.

From these considerations I should conclude that the vestigial teeth which I have described in *Hyrax* (*viz.*, the two posterior upper incisors and the lower canine), together with the upper canine described by Lataste, which has not been seen to be replaced by a successional tooth although sometimes persisting with the permanent teeth, belong exclusively to the 1st or milk series, which would then read as follows, *viz.* :—

$$i. \frac{3}{2}, c. \frac{1}{1}, pm. \frac{4}{4} = 30,$$

while the adult dentition would be

$$i. \frac{1}{2}, c. \frac{(1)}{0P}, pm. \frac{4}{4}, m. \frac{3}{3} = 34 (? 36).$$

IV. *The Milk-Dentition of the Rabbit* (*Lepus cuniculus*).

Although the Rabbit is so universally studied in our own laboratories and its anatomy is described in detail in so many of our practical hand-books, not one of the latter rightly describes its milk-dentition, in spite of the fact that all the details concerning it have been long ago recorded.

If one examines the jaws of a Rabbit from 2-3 weeks old (Plate II. fig. 3), one finds on each side of the upper jaw 6 incisors arranged in two linear series, 3 on each side of the middle line; the anterior tooth of each set is known to be the great permanent front incisor, while the others have been variously interpreted.

F. Cuvier (3), in the first place, described them as representing the 2nd and 3rd upper incisors; his statement has been copied by several authors (9, 15, 29), who have thus ascribed to the Rabbit at birth 3 incisors, stating that the outer one is soon lost.

This determination of Cuvier's was refuted by Owen (23) as long ago as 1868 and later by Krause (17). These two observers show that the middle tooth of each series (fig. 3,  $di^2$ ) is in reality the 2nd milk-incisor; it is a functional tooth for the first three weeks of the animal's life, after which time it is shed, being pushed out by its successor (fig. 3,  $pi^2$ ). The deciduous tooth in the specimen figured is small and wedge-shaped, its crown being much worn, while its successor presents a conical unworn extremity, having only just cut the gum. This latter tooth is the one described by Cuvier as being the 3rd incisor and by others as being early lost (9, 15, 29).

The probable reason that the 2nd milk-incisor and its successor are present for some time side by side, after the latter has cut the gum, may be implied in the fact that the deciduous tooth is as it were wedged in between the great anterior incisor and its own successor and is rather worn away by attrition than shed.

The study of the development of these teeth shows at once that these two (fig. 3,  $di^2$ ,  $pi^2$ ) are formed from a common enamel organ, and that they possess the relations of a typical tooth of the 1st to its successor in the 2nd dentition. The fact that the permanent tooth cuts the gum posteriorly to the milk-tooth, instead of developing underneath the latter and gradually pushing it out, goes for nothing, when we consider that the permanent tooth is typically developed on the inner side of its milk predecessor and not below it.

We see from the above that there are only 2 incisors on each side of the adult upper jaw, and no examination of even the youngest fœtus in which the teeth are appearing shows us any trace of a 3rd one.

The deciduous premolars of the upper series are 3 in number, and, as may be seen, they persist until the animal is between 3 and 4 weeks old (not, as stated by Marshall and Hurst (22), being shed before birth). These teeth have been long known and are figured by Owen (23); the principal point of interest about them is their possession of true fangs and their replacement by more specialized teeth which grow from persistent pulps.

Completing the cheek-teeth above we find at the same age 2 molars in use, and a 3rd developing one buried up in the maxilla.

The lower teeth at this age call for no special comment; there are the characteristic inferior incisors (1 on each side), 2 deciduous premolars, having the same characters as those of the upper set. Behind these are 2 molars, the 3rd not having yet cut the gum.

In a footnote to a paper printed in the 'Proceedings' of this Society, Prof. Huxley (16) in 1880 mentioned that he had discovered in the foetal Rabbit vestigial milk predecessors to the large upper and lower incisors, thus making the full milk or 1st dentition to be  $i. \frac{2}{1}, pm. \frac{3}{2}$ . This discovery has been generally overlooked by the writers of works dealing with the Mammalia and the Lagomorpha.

Having examined his preparations and subsequently worked out this point in a number of foetal Rabbits from the time when the teeth first appear until birth, I can entirely confirm Huxley's statement.

Fig. 4 is a drawing of the clarified jaws of a foetal Rabbit.

At this period there are present 7 teeth in the upper and 5 in the lower jaw. Of those in the upper jaw the first 3 are incisors, the large tooth ( $pi^1$ ) being the permanent anterior one and the smallest tooth ( $di^2$ ) being the milk 2nd incisor, the permanent one not being yet differentiated. The cheek-teeth are 4 in number and represent the 3 deciduous premolars ( $d.pm.$ ) and the 1st molar ( $m^1$ ).

In the lower jaw the large incisor ( $pi_1$ ) is well developed, but there are only 3 cheek-teeth, viz. the two milk premolars ( $d.pm.$ ) and the anterior molar ( $m_1$ ). In front of each of the large incisors ( $pi^1, pi_1$ ), above and below, is a small tooth ( $di^1, di_1$ ), rather irregular in appearance, but with its crown composed of typical layers of enamel and dentine (fig. 5,  $di^1, di_1$ ), and possessing all the essential structures of a tooth. In size these teeth are the smallest in the jaws and measure as follows:—the upper one ( $di^1$ )  $\cdot 13$  millim. long  $\times$   $\cdot 09$  wide; the lower one ( $di_1$ ), which is much larger and varies somewhat, being  $\cdot 19$ - $\cdot 34$  millim. long and  $\cdot 12$ - $\cdot 16$  wide.

Examination of young jaws shows that these minute teeth are among the first to develop, and when they appear they attain with their enamel organs a relatively large size in proportion to the jaw. Their growth is early arrested and they remain in a dwarfed condition; if carefully examined they are seen to present an irregular contour, and this I regard as expressive of their partial absorption. They are eventually forced out of the gum, about birth, by the growing permanent teeth.

These small teeth develop in common enamel organs with the permanent cutting-incisors, of which they are, as Huxley pointed out, the milk predecessors. As has been shown, they are never functional, and, like the milk-premolar of the Guinea-pig (*Cuvier*), they are shed *in utero*.

The Rabbit, so far as we know, is the only Rodent possessing milk predecessors to both incisors; while it and the Common Hare are the only Rodents known to possess deciduous incisors.

There can be very little doubt that the Duplicidentata, as concerns their teeth, are the most primitive living Rodents; and as the deciduous front incisors have almost disappeared in them, we could hardly expect to find them present in the more modified forms, where the teeth are reduced in number. It is, however, highly probable that we might find them in the Hare and possibly in *Lagomys*.

Krause (17), in describing the deciduous teeth of the Rabbit, gives the formula  $i. \frac{2}{1} pm. \frac{3}{2}$ ; which, as I have shown, is the correct one; but although he gives the correct formula, he cannot have seen the small deciduous first incisors; in fact, he says (*op. cit.* p. 199) "the four large incisors persist from the beginning"; so that he counts the large cutting-incisors twice over, first in the deciduous and afterwards in the permanent dentition, solely on the grounds that they happen to be formed very early, when none but milk-teeth are present in the jaw.

The discovery of these teeth is entirely due to Huxley, but as he only mentioned it in a passing footnote appended to a paper dealing with much wider questions, and as he never figured them, I append figures, in illustration of my more detailed account of them.

In concluding, I should like to express my thanks to Mr. Oldfield Thomas for his kind assistance in allowing me access to a fine series of *Hyrax* skulls in the British Museum, and to Prof. Howes for his valuable advice and suggestions during the progress of this work.

#### V. List of References.

1. BLAINVILLE. Ostéographie, t. vi. p. 38.
2. BRANDT, J. F. "Ueber d. Gattung d. Klippschliefer (*Hyrax*)." *Mém. Ac. Pétersb.* (7) xiv. 1869.
3. CUVIER, F. Dents d. Mammif. 1825.
4. CUVIER, G. *Ann. d. Mus. Paris*, t. iii. 1804, p. 177.
5. ——. *Recherches s. l. oss. Fossil.* 4th ed., t. iii. 1834, p. 253.
6. FLOWER, W. H. "On the Homologies of the Teeth of the Mammalia." *J. Anat. Phys.* vol. iii. 1869, p. 262.
7. ——. "On the Milk Dentition of Mammalia." *Trans. Odont. Soc.* 1871.
8. ——. "On the Succession of the Teeth in the Marsupialia." *Phil. Trans.* vol. 157, 1867, p. 631.
9. FLOWER, W. H., & LYDEKKER. "Mammalia." Lond., 1891.
10. GEORGE. "Monogr. Anat. d. Daman." *Ann. Sci. Nat.* (6) t. i. 1874, Art. 9, pp. 83-86.
11. GERVAIS. *Hist. Nat. d. Mammif.* 1855.
12. GIEBEL. *Odontographie*, p. 75, 1855.
13. ——. *Bronn's Thier-Reich*, Bd. vi. Abth. v. p. 118, 1875.
14. GRAY, J. E. *Cat. of Carniv. and Pachyderm. Mammalia* Brit. Mus. 1869.

15. HUXLEY, T. H. Manual Vert. Anat. 1871.
16. ——. "Evolution and the Arrangement of the Vertebrata." P. Z. S. 1880, p. 655.
17. KRAUSE. Anat. d. Kaninchens. Leipzig, 1884, p. 198.
18. KÜKENTHAL, W. "Bemerkungen ü. d. Säugetier-Bezeichnung." Anat. Anz. 1891, pp. 364, 658.
19. LATASTE, F. "S. l. Système Dentaire d. Daman." Ann. Mus. Genov. (2) t. iv. (xxiv.) 1886, p. 5.
20. MILNE-EDWARDS. Mammif. 1868.
21. ——. Leçons s. l. Physiol. t. 6 (1860).
22. MARSHALL & HURST. Practical Zoology, 2nd ed. 1888.
23. OWEN, R. Comp. Anat. Vert. vol. iii. p. 356 (1868).
24. ——. Odontography.
25. PALLAS. Miscell. Zool. 1776, p. 34.
26. THOMAS, O. "Milk-Dentition of *Orycteropus*." Proc. Roy. Soc. vol. xlvii. 1889-90, p. 246.
27. ——. "Homologies and succession of Teeth in *Dasyuridæ*." Phil. Trans. vol. 178. B. 1887, p. 443.
28. WAGNER, A. Schreber's Die Säugethiere, 1844, Bd. 4, p. 307.
29. WATERHOUSE. Nat. Hist. Mamm. vol. ii., 1848.

## EXPLANATION OF PLATE II.

Milk-dentition of *Hyrax capensis* and *Lepus cuniculus*.

*n* = nasal.

*pmx* = premaxilla.

*mx* = maxilla.

*md* = mandible.

*ms* = premaxillo-maxillary suture.

*di*<sup>1</sup>, *di*<sup>2</sup>, *di*<sup>3</sup> = upper deciduous incisors.

*di*<sub>1</sub>, *di*<sub>2</sub>, *di*<sub>3</sub> = lower deciduous incisors.

*pi*<sup>1</sup>, *pi*<sup>2</sup> = upper permanent incisors.

*pi*<sub>1</sub> = lower permanent incisor.

*c* = upper canine; *c*<sub>1</sub> = lower canine.

I, II, III, IV = the 4 deciduous premolars.

*d.pm* = deciduous premolars.

*m*<sup>1</sup> = 1st upper molar; *m*<sub>1</sub> = 1st lower molar.

*d* = dentine; *e* = enamel; *f* = fang; *p.c* = pulp-cavity.

- Fig. 1. Clarified jaws of a fetal *Hyrax*, showing the teeth *in situ*,  $\times 4$ .
2. Enlarged drawings of the 2nd and 3rd upper incisors (*di*<sup>2</sup>, *di*<sup>3</sup>) and the lower canine (*c*<sub>1</sub>) of the above,  $\times 50$ .
  3. Clarified vertical longitudinal section through the premaxilla of a Rabbit, showing the relation of the permanent front incisor (*pi*<sup>1</sup>) and the deciduous (*di*<sup>2</sup>) and permanent (*pi*<sup>2</sup>) second incisor.
  4. Clarified jaws of a fetal Rabbit, shortly before birth, to show the vestigial milk anterior incisors (*di*<sup>1</sup> and *di*<sub>1</sub>).
  5. Enlarged drawing of the vestigial anterior milk-incisors of the Rabbit,  $\times 100$ .

## 5. On the Species of the Hyracoidea.

By OLDFIELD THOMAS, F.Z.S.

[Received December 1, 1891.]

(Plate III.)

The present paper is an attempt to work out the species contained in the group Hyracoidea, a group which has of late years attracted the attention of several prominent systematic workers, but which, owing partly to its inherent difficulties and partly to want of material, has remained in a terrible state of chaos. The difficulties of the subject are indeed so great, owing mainly to the slight differences and great variability of the species, that in spite of my material being many-fold greater than that available for any of my predecessors, I can only feel that my results are quite provisional, and will need further revision when larger and better series from more localities are obtained.

The material before me consists of about 120 skins and spirit specimens, and 122 skulls and skeletons, a number far in excess of what any previous worker has had. This number is made up, firstly, of the Museum series (71 skins &c., 67 skulls), which contains the types of the species described by Gray<sup>1</sup> in his many papers on the subject, and the large series of Abyssinian specimens collected by Mr. W. T. Blanford and used as the basis of his work on the group.

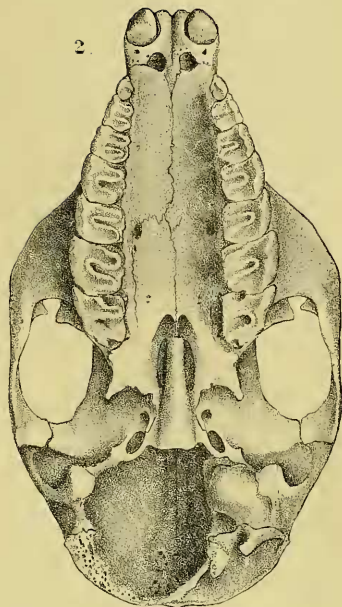
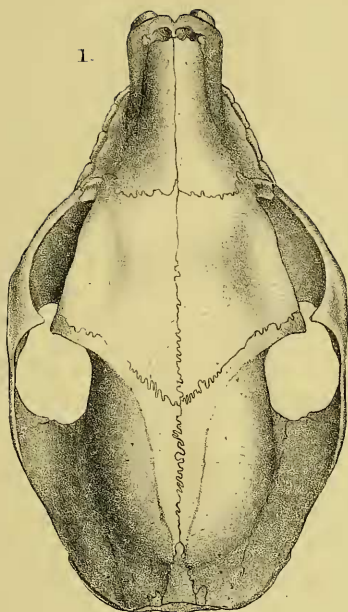
Secondly, the fine series (47 skins &c., 48 skulls) belonging to the Genoa Museum, containing large numbers of the Abyssinian and Shoan forms and also the only good specimens that I have seen of the Senegal Hyrax (*Procavia latastei*). This collection formed the basis of M. Lataste's work on the group<sup>2</sup>—work only just begun, and of which only a few preliminary remarks had been published, but work nevertheless of the highest and most thoughtful character, so that it has been a great misfortune in this respect that M. Lataste has had to throw up the Hyracoidea on quitting Europe for S. America. All his drawings and notes, however, have been transmitted to me by the Marquis G. Doria, to whom I also owe the loan of the collection itself, and to whom therefore my most sincere thanks are due.

Thirdly, four skulls of the Angolan species, including the type skulls of both *P. welwitschii* and *P. grayi*, kindly lent me by Prof. Barboza du Bocage of the Lisbon Museum, these being the skulls described and figured by him in his excellent paper on the genus published in 1889.

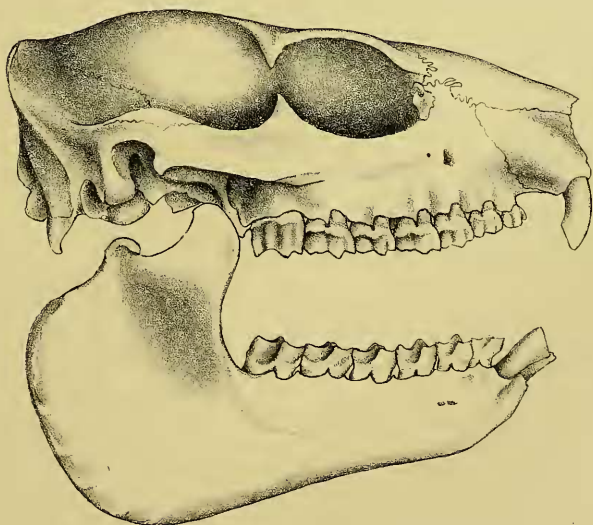
Fourthly, two skulls of *P. syriaca* lent me by Dr. P. Matschie of the Berlin Museum, with the permission of Prof. Möbius. I am also indebted to the former for much assistance in reference to the

<sup>1</sup> Except that of *P. welwitschii*.

<sup>2</sup> Ann. Mus. Genov. (2) iv. p. 5 (1886).



3.







type specimens of Hemprich and Ehrenberg's species preserved in Berlin.

Fifthly, a skin of the same species lent me by Canon H. B. Tristram of Durham.

It will be seen therefore that not only is the present series unprecedentedly large in point of numbers, but that it contains the actual specimens referred to by all the chief writers on the subject of recent years, viz. Gray, Blanford, Lataste, and Bocage.

Of their papers I would call special attention to that by M. Lataste, already briefly referred to, on the skulls and dentitions of the different "subgenera," and especially to his theory that the minute anterior maxillary tooth of the milk-dentition is a milk-canine which does not have a successor. This theory I believe to be perfectly correct, and am most glad to be able independently to confirm Lataste's observation. This tooth appears most certainly to be homologous with the milk-canine of other mammals, even though it is ordinarily situated some way behind the maxillo-premaxillary suture.

M. Lataste's other work on the group, being in the form of drawings and rough notes, I have found it very difficult to utilize, especially as our opinions are naturally very frequently divergent. If, however, I have published any observation which he has previously discovered and recorded, I must ask his pardon and plead as an excuse the very rough character of the notes which he has made.

The excellent paper by Prof. Barboza du Bocage<sup>1</sup> should also be referred to, as he has given in it not only full and detailed descriptions of the three Angolan species, in some ways the most interesting, because the most annectant, of the genus, but he has also given a complete list of all the known species, with notes on their characters and localities. This paper has therefore naturally been of much service to me while going over the same ground.

To pass now to the subject-matter of this paper. In the first place, it must be admitted that, as pointed out by Lataste, the time-honoured name of *Hyrax*<sup>2</sup> should be superseded by that of *Procavia*<sup>3</sup>, earlier by three years than *Hyrax*. The family name will therefore be *Procaviidae*, but the ordinal or subordinal name will remain Hyracoidea as before, a name of this rank not necessarily being based on that of a constituent genus. "Hyrax" might, however, be adopted as an English vernacular name, the species of *Procavia* not having as yet one generally and correctly applicable to them.

Secondly, there arises the important question as to whether all the Hyraces should be placed in one genus, or whether "*Heterohyrax*" and "*Dendrohyrax*," both proposed by Gray and admitted by Lataste and others, should be recognized as distinct genera or subgenera.

Now on this point I find it very difficult to come to a definite conclusion. Within the group there are two extremes, typified, for example, by *P. abyssinica* and *P. dorsalis*—the former with their

<sup>1</sup> J. Sci. Lisb. (2) iii. pp. 186-196 (1889).

<sup>2</sup> Herm. Tab. Aff. Anim. p. 115 (1783).

<sup>3</sup> Storr, Prodr. Syst. Mamm. p. 39 (1780).

molar teeth very large, hypsodont, and like those of a Rhinoceros in character, while the latter have small, brachyodont, Palæotherium-like teeth; and these two extremes have been commonly looked upon as the types of distinct genera, respectively *Procavia* (= *Hyrax*) and *Dendrohyrax*. But unfortunately there is really almost a perfect graduation in characters from the one extreme to the other, the chief link being formed by *P. brucei*, a species which has been made the type of a third genus or subgenus, *Heterohyrax*. Now this *Heterohyrax* has the essential dental characters of *Dendrohyrax* combined with the skull of *Procavia*; while the one cranial peculiarity supposed to be characteristic of it, the early closure of the interparietal sutures, is not present in *P. latastei*, a species otherwise in every respect identical with *P. brucei*. On the other hand, the perfect orbits characteristic of *Dendrohyrax* occur in a form called "*D. grayi*," which, except for this one character, does not differ either cranially or externally from *P. bocagei*, and will perhaps prove to be only a variety of that animal. One single external character, however, distinguishes the three most typical *Dendrohyraxes*, *P. dorsalis*, *arborea*, and *valida*, from all the other species in which the point has been noticed, namely the number of the mammæ. These three species have a mammary formula of 0—1=2, while certainly in *P. syriaca*, *ruficeps*, *abyssinica*, *shoana*, *welwitschii*, and *brucei*, and therefore, judging from analogy, probably in *P. capensis*, *pallida*, *bocagei*, and *latastei*, there are 1—2=6. The mammary formulæ of "*Dendrohyrax grayi*" and *P. emini* cannot be forecasted, and therefore particularly need observation. In any case, however, this character cannot be used as of generic value, for it separates "*Dendrohyrax*" equally from both "*Heterohyrax*" and "*Procavia*," although the teeth prove that, if anywhere, the division should come between *Heterohyrax* and *Procavia*. But even then one would not know into which group to place such an annectant form as *P. welwitschii*. Balancing, therefore, these considerations for and against the retention of *Dendrohyrax* and *Heterohyrax*, I have come to the conclusion that it is better on the whole to recognize only a single genus for the whole of the Hyraces, which will of course bear the name of *Procavia*.

Before passing to the actual descriptions of the different species, a few words are necessary as to the cranial, dental, and external characters found in the group, as a proper understanding of these is essential to anyone trying to work out the species of this most difficult group.

Firstly, it may be noted that, thanks to the work of Lataste already quoted, and still more to the important paper by Mr. Woodward just read to the Society (*suprà*, p. 38), the homologies of the teeth are fortunately quite clear throughout. Especially noteworthy is the discovery of rudimentary outer milk-incisors, a discovery which proves the persistent incisors to be really homologous with the first incisors of normal mammals. Lataste's determination of the anterior upper cheek-tooth of the milk-series as mc is fully confirmed by Woodward, whose discovery of a corresponding lower milk-canine is of much interest.

Owing to the comparative lateness in life at which apparently the Hyraces become fully adult, and the consequent frequency with which more or less immature specimens have to be dealt with, special attention has to be paid to the age of every specimen described. For purposes of comparison therefore the period of tooth-development has been divided into eight stages, mostly determinable by the relative development of a single tooth, and thus by the comparison of specimens of similar ages the true inherent differences in size between different forms become easily definable. A single tooth only is taken as the main determinant of each of the stages, no account of the general state of the dentition at any given stage being practicable for all species, owing to the fact, observed by Lataste, that the time of the fall of the milk-premolars as compared with the development of the permanent molars varies in different species.

The following are the stages which I have found divide the specimens most conveniently into groups of individuals of similar age. The actual age, in time, at which in the different species these stages are attained may perhaps be found out later at a more advanced period of knowledge:—

Stage I. Before the milk-dentition is fully in place.

II. Milk-dentition all up and in use.  $m^1$  not visible.

III.  $m^1$  up;  $m^2$  below level of bone.

IV.  $m^2$  just appearing or partly up.

V.  $m^2$  nearly or quite up;  $m^3$  below level of bone.

VI. Tip of  $m^3$  appearing.

VII.  $m^3$  partly or nearly up, but still unworn.

VIII.  $m^3$  up and in use.

No doubt Hyraces are practically adult, and are probably breeding, some time before Stage VIII. is attained, just as in the Kangaroos and other animals in which there is a horizontal succession of the teeth owing to the movement forward of the tooth-row, and the consequent replacement of the crushed and worn-down anterior teeth by the newly formed posterior ones. Of course the process is not nearly so highly developed as it is in the Kangaroos, Manatees, and others; but there is evidently a commencement of this remarkable provision for the replacement of the worn-out teeth in the Hyracoidea, especially in the hypsodont species, such as *P. capensis*, *abyssinica*, and their allies.

Thanks to this process, the actual size of the teeth, however valuable for the discrimination of the species, cannot be defined satisfactorily by a simple antero-posterior measurement of the tooth-row or any part of it, for the larger posterior teeth as they push forwards gradually crush together the whole of the teeth and make their combined length less and less as time goes on.

To gain an idea of the actual size of the teeth, it has therefore been found best to take the exact horizontal breadth of  $m^1$  at its broadest point, this tooth being present and available in specimens at all ages from Stage III. upwards.

As to the height of the teeth, by which their hypsodontism or brachyodontism can be gauged, the height of the crown of  $m^3$  has been taken as the basis. It is measured, in a tooth as unworn as possible, from the top of the main anterior cusp<sup>1</sup> to the bottom of the valley on the outer side of the cusp; when there is any trace of a cingulum it is placed at this point, but when there is not, the point at which the valley merges into the smooth basal outer surface of the tooth may always be clearly made out.

The upper incisors of the Hyraces are of two forms, the one sharply ridged and angular in front, and the other more or less rounded or even flat anteriorly. This difference, though often incidentally noticed, never seems to have been referred to sex, of which, however, I believe it affords a constant index. The study of so large a series of specimens as the present proves conclusively that all the specimens with ridged incisors are males, and those with them rounded are females. It is of the greatest value to have this ready index to the sex of skulls, as so large a number are either without skins, or if these exist they are unsexable. It should be noticed, however, that in certain species, notably *P. dorsalis*, *arborea*, and *brucei*, the female incisors are also to a certain extent ridged, but to a degree very slight in comparison with those of the male sex.

Other differences due to sex seem to be few and unimportant. Even as to size, although male skulls on the whole are rather larger than female ones, yet individual female skulls often exceed the great mass of the males. To take an instance, in *P. shoana* 5 male skulls give the following lengths—89, 90, 91, 92, 93, and 6 females the following—82, 84, 84, 85, 87, 88; but one of the types of the species, unquestionably a female, has a length of 96 mm., thus exceeding any of the males as yet recorded. Almost precisely the same thing occurs in the series of *P. capensis*, where our largest specimen is a female. No general rule therefore can be laid down as to the relative sizes of the two sexes.

Throughout the history of the systematic arrangement of the Hyraces the interparietal bone has had a large share in causing confusion owing to the alterations that take place in its shape during life not being allowed for or understood. It was early seen that different specimens had very differently shaped interparietals, and in the absence of good series at different ages these differences were naturally supposed to be of specific value. Thus Hemprich and Ehrenberg in 1828 laid primary stress on the shape and form of this bone in separating the four species they recognized; while much later Gray referred a great deal to it, and the retention of "*Heterohyrax*" as a subgenus by Lataste practically depended on the age at which it is united to the other bones of the skull. On the examination of a large series of specimens, however, it appears that this bone is by no means really so important as has been supposed for diagnostic purposes, and that its differences in shape are really due to

<sup>1</sup> Not the extreme antero-external cusp, which has no valley on its outer side; the cusp measured from is nearly always the highest one of the tooth.

age, while its fusion or non-fusion with the other bones of the skull, although generally constant, is a character rather more variable than has been supposed.

In a young specimen of one of the species in which it is generally distinct through life, the bone is clearly marked, ordinarily broadly trigonal in shape, its broad posterior end generally embraced by two little processes of the supraoccipital, but these vary very much in their development. At this stage its edges are vertical to the plane of its surface, or if there is any slanting, it is in such a direction that the inner cerebral aspect is rather smaller than the outer. This condition of things remains constant up till somewhere about Stage V., when the ever extending temporal muscles begin to encroach in its vicinity. These muscles seem to induce the development as part of the parietals of a roughened surface-layer of bone, which, with the muscles, gradually creeps onwards over the brain-case, and by degrees encroaches on and covers up the interparietal bone. The two parieto-interparietal sutures therefore constantly get closer together, the interparietal bone naturally appearing narrower and narrower, and at last the two temporal ridges, which have already met some time before anteriorly, gradually coalesce further and further back, and finally block out all trace of the interparietal bone on the upper surface. Even then, however, for a long period the bone may remain uncoalesced, its sutures, in section, describing a curved line following the increase of the parietal bone over it. This gradual narrowing upwards of the interparietal may be seen well in the British Museum skull, No. 69. 10. 24. 41, of *P. abyssinica*, in which, although the bone itself is broken away, the sutural edge of the parietal clearly exemplifies the steady extension of their upper layers at the expense of the smaller bone between them.

Now as to the closing of the parieto-interparietal sutures, the early obliteration of which is the main character on which the group "*Heterohyrax*" rests, some words are necessary, as although really useful in many cases for specific determination, yet the character is not one that can be used for breaking the family up into smaller groups. In the great majority of the species these sutures are ordinarily persistent and visible, except in so far as they are covered up in the manner above described. On the other hand, in *P. brucei* they close up so soon that in two specimens as young as Stage III. they have quite disappeared, and in one of Stage II. they are only faintly visible. But two closely allied species, here provisionally admitted as such, but really only doubtfully distinguishable from *P. brucei*, have either persistent sutures (*P. latastei*), or temporary ones, closing up as the animal gets fully adult (*P. bocagei*), thus proving that the character is at most only of specific importance.

A second character on which much stress has been laid, and one which has been supposed to be above all suspicion of variability, is the completion or non-completion of the orbit behind by bone. This is always accepted as the essential character of the group "*Dendrohyrax*," and certainly, in the most typical species, *P. dorsalis*,

the orbit is closed, even in the youngest specimens available, down to Stage I. In *P. arborea*, however, the South-African form, one of our four specimens, already fully adult (Stage VIII.), has the postorbital processes of the frontal and malar separated by at least 2 mm.<sup>1</sup>, the other three having closed orbits. On the other hand, the type of *Dendrohyrax grayi* has them completely closed, as has also a second specimen from the same region; but I am nevertheless most strongly inclined to consider these two specimens as only representing an individual variation of *P. bocagei*<sup>2</sup>.

As it appears therefore from both these characters that the Angolan Hyrax is the one which presents the greatest difficulty, I would strongly impress on collectors having the opportunity the great desirability of obtaining more specimens from that country. In this connection I must again thank Prof. Barboza du Bocage for the loan of the valuable Angolan specimens preserved in the Lisbon Museum, a loan which has been of the very greatest service to me.

The development of the anterior lower premolar ( $\overline{p}^1$ ) is worthy of some notice. In the large-toothed, hypsodont species, such as *P. capensis*, *abyssinica*, &c., it is a simple slender tooth, with only one root, and is pushed out by the teeth behind it at a very early age, so that it is quite unusual to find it present in fully adult animals. On the other hand, in the small-toothed brachyodont species it is elongated, has two distinct roots, and is practically persistent throughout life. These differences are clearly correlated with the amount of the wear and tear of the teeth and their movement forwards in the jaw, characters at their maximum in the hypsodont and their minimum in the brachyodont species.

The predecessor of this tooth ( $\overline{mp}^1$ ) is always long and double-rooted, showing clearly which of the two adult forms is the primitive one of the group.

The number of the ribs has also been used as a distinguishing character of the genera and subgenera, but, so far as I have seen, all the species examined (including such widely separated species as *P. dorsalis*, *brucei*, and *abyssinica*) have 21 (rarely 20), while *P. capensis* alone has 22. I have, however, thought it worth while to record the numbers in the specific descriptions wherever I have direct knowledge of them.

Of the external characters by which the different species may be determined, the most important are the coloration, shape, and size of the dorsal spot, a patch of hairs growing on and around the dorsal gland, and almost invariably of a colour markedly contrasting with that of the body in general.

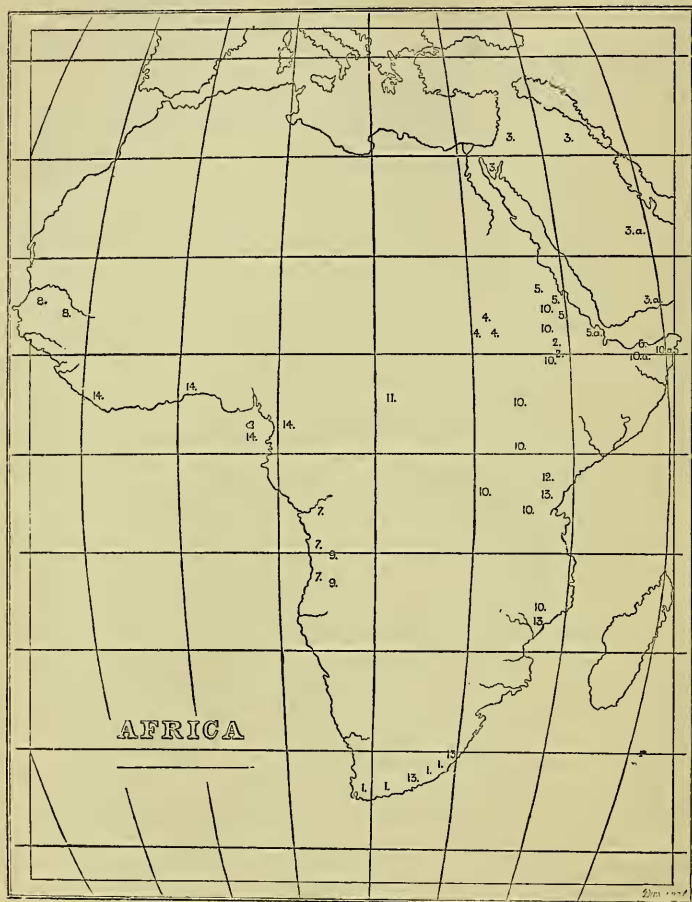
The following are the chief variations in the dorsal spot met with in the different species:—

<sup>1</sup> On one side; the other is broken.

<sup>2</sup> See below p. 72.



*Map showing the Distribution of the Species of Procavia.*



1. *Procavia capensis.*
2. — *shoana.*
3. — *syriaca.*
- 3 a. — *jayakari.*
4. — *ruficeps.*
5. — *abyssinica.*
- 5 a. — *minor.*
6. — *pallida.*
7. — *welwitschii.*

8. *Procavia latastei.*
9. — *bocagei.*
10. — *brucei.*
- 10 a. — *somalica.*
11. — *emini.*
12. — *valida.*
13. — *arborea.*
14. — *dorsalis.*



TABLE I.—Basal Lengths (in millim.).

	Stage I.	Stage II.	Stage III.	Stage IV.	Stage V.	Stage VI.	Stage VII.	Stage VIII.
1. capensis .....	.....	57, 58, 62.	.....	.....	69, 74, 74, 75, 77, 79, 79.	69, 83.	.....	82, 87, 93, 84, 85, 87, 88, 90, 92, 93, 96*.
2. shoana .....	.....	.....	.....	.....	.....	.....	82, 84.	.....
3. sylvica .....	.....	.....	61, 67.	.....	.....	.....	72.	77, 73*.
3a. " jayakari.....	.....	.....	.....	.....	.....	.....	.....	78, 86.
4. ruficeps .....	.....	.....	.....	.....	.....	.....	.....	75, 78, 80, 82,
5. abyssinica .....	.....	52.	61.	68, 71.	75*.	76.	73.	83, 84, 87.
5a. " minor .....	.....	.....	.....	.....	.....	65*.	.....	(φ) 72*.
6. pallida .....	.....	.....	.....	.....	.....	.....	.....	73*.
7. welwitschii.....	.....	.....	.....	.....	.....	.....	.....	.....
8. latastei .....	.....	51.	.....	66, 67, 70*.	.....	73, 75*.	.....	.....
9. boaegei .....	.....	.....	.....	73*.	.....	.....	.....	79.
10. brucei.....	.....	.....	64, 67.	.....	76.	75.	75, 76, 78.	79, 80, 81, 82.
10a. " somalica .....	.....	.....	.....	.....	64.	67.	.....	65, 74*.
[Grayi .....	56*.	.....	.....	.....	.....	(φ) 82*.]	.....	.....
11. emini .....	.....	.....	.....	.....	.....	.....	.....	.....
12. valida.....	.....	.....	.....	.....	.....	.....	.....	82, 86, 87, 92.
13. arborea.....	.....	.....	.....	.....	.....	.....	.....	93, 100, 113.
14. dorsalis .....	56, 56.	.....	77.	.....	.....	.....	.....	.....

\* Types or co-types.

TABLE II.—*Sizes of Teeth* (in millim.).

	(a) Breadth of $\underline{m^1}$ .	(b) Height of crown of $\underline{m}$ .	(c) Length of $\overline{p^1}$ .
1. <i>capensis</i> .....	7.0, 7.5, 8.0.	7.1, 7.5.	2.5, 2.7.
2. <i>shoana</i> .....	7.1, 7.3, 7.8, 8.1.	7.3.	2.6, 2.8.
3. <i>syriaca</i> .....	7.1, 7.2, 7.4.	7.0.	2.2.
3a. „ <i>jayakari</i> .....	6.2, 6.4.	(c) 5.5.	.....
4. <i>ruficeps</i> .....	7.0, 7.3, 7.7.	6.9.	2.5, 2.6.
5. <i>abyssinica</i> .....	6.7, 7.0, 7.4, 7.8, 7.9.	6.9, 7.0.	2.0, 2.2.
5a. „ <i>minor</i> .....	6.3, 6.6.	.....	.....
6. <i>pallida</i> .....	6.9.	5.4.	.....
7. <i>welwitschii</i> .....	6.5, 6.7.	5.2.	4.1.
8. <i>latastei</i> .....	6.0, 6.3, 6.5.	.....	3.0, 3.1.
9. <i>bocagei</i> .....	5.4, 5.6, 6.4.	4.5.	3.7, 3.9.
10. <i>brucei</i> .....	5.4, 5.7, 6.0.	4.5.	2.8, 3.0, 3.4.
10a. „ <i>somalica</i> .....	5.0, 5.2.	4.5.	3.0, 3.1.
[ <i>grayi</i> .....	6.0, 6.1.	.....	4.0.]
11. <i>emini</i> .....			
12. <i>valida</i> .....			
13. <i>arborea</i> .....	6.0.	3.5.	3.5, 3.8.
14. <i>dorsalis</i> .....	6.6, 6.8.	4.1, 4.3.	4.7, 4.8.

1. *PROCAVIA CAPENSIS*.

*Cavia capensis*, Pall. Misc. Zool. p. 30 (1766).

(?) *Hyrax semicircularis*<sup>1</sup>, Gray, Cat. Carn. Pachyd. p. 285 (1869);  
Hand-l. Edent. &c. p. 44, pl. xii. fig. 2 (1873) (skull).

Fur of medium length, soft and fine; neither so long nor so fine as in *P. shoana*. Ears short, rounded. General colour dark sepia-brown, finely speckled with white or pale yellow. Straight upper-fur hairs dark brown, with a small pale yellow subterminal band; underfur along the centre of the back dark smoky grey throughout, but along the sides, grey basally, and shining silvery yellow distally. Belly dirty yellow or brownish.

Dorsal spots entirely black, irregularly oval in shape, not so large as in *P. shoana*.

Skull<sup>2</sup> broad, stout and strong; muzzle short; interparietal sutures always persistent. Diastema short, 8 to 10 mm. Teeth large and hypsodont, but very variable in size; of the few specimens with exact localities the eastern ones, from Natal &c., seem to have smaller teeth than those from the Cape itself. Diameter of  $\underline{m^1}$  8.0 in a Cape specimen, 7.0 in a Natal one, those being the extremes observed. Height of crown of  $\underline{m^2}$  7.1 to 7.5.  $\overline{p^1}$  minute, single-

<sup>1</sup> The young skull on which this species was founded has not got completed orbits as stated by Gray, the connections being only ligamentous. There appears to be nothing to distinguish it from skulls of *P. capensis* of the same age, but the skeleton shows only 21 pairs of ribs. It is also just possible that *Hyrax nigricans*, Peters, SB. Ges. Fr. 1879, p. 10, belongs here, in which case the species extends very much further north-west than has been supposed. The type specimen, however, is too young for certain determination.

<sup>2</sup> Good figure: De Blainville, Atl. iii. Hyrax, pl. ii.

rooted, early deciduous, rarely or never present in adult specimens. Ribs 22.

*Hab.* Cape Colony, from the Cape<sup>1</sup> to Natal<sup>2</sup>.

## 2. *PROCAVIA SHOANA*<sup>3</sup>.

*Euhyrax abyssinicus*, Gray, Ann. Mag. N. H. (4) i. p. 47 (1868) (nec *Hyrax habessinicus*, Hempr. & Ehr.).

*Hyrax scioanus*, Gigl. Ann. Mus. Genov. (2) vi. p. 21 (1888).

Size very large, form stout and heavy. Mammæ 1—2=6. Fur very long, soft, and fine. General colour grizzled olivaceous grey, the straight lines of the back brown basally, with a broad dull yellow subterminal ring and black tip. The greater breadth of the yellow ring and the larger number of the straight hairs as compared to the woolly underfur quite take away the appearance of fine speckling characteristic of *P. capensis*, and produce a much coarser mottled appearance. Underfur coloured as in *P. capensis*, but the yellow band on both of the sides is broader, and its colour is duller and more tinged with olivaceous. Belly dirty yellow or brownish.

Dorsal spot very large and diffuse, wholly black, very prominent in well-marked examples.

Skull large and heavy, but very variable in its proportions, especially in the length of the muzzle, and consequently in the length of the diastema. In the female co-type<sup>4</sup> the latter is fully 14 mm. long, while in another specimen it is only about 5 mm., but in the large Genoa Museum series nearly all the intermediate links are represented. On the whole the skull cannot be definitely distinguished from that of *P. capensis*, although ordinary specimens rather larger of the northern than of the southern form. Teeth also very variable in size:  $\overline{m}^1$  from 7.1 to 8.1 in breadth; crown of  $\overline{m}^3$  about 7.2 or 7.3 high;  $\overline{P}^1$  small, single-rooted, about 2.6 or 2.8 in horizontal length. 22 ribs (in one specimen).

*Hab.* S. Abyssinia and Shoa.

*Co-types* (♂ & ♀) from Ankober, collected by Major W. C. Harris. Other specimens from the Dalanta and Wadela Plateaux, S. Abyssinia (*Blanford*), Lit Marafia, Denz, Askalena, Monte Mabrat, and other neighbouring localities in Shoa (*Antinori*, *Ragazzi*, and *Beccari*).

This fine Hyrax, almost if not quite the largest of the genus, has been the cause of great trouble and uncertainty among writers on the group ever since Gray first described the specimens obtained by Capt. Harris at Ankober, these specimens being therefore the co-types of the species as renamed by Giglioli. Gray's reference of this

<sup>1</sup> I have myself seen these animals in numbers on the rocks near Fishhoek, a small village on the eastern side of False Bay. Further west than this I know of no exact record of their occurrence.

<sup>2</sup> The Museum owes to the Rev. W. D. Newnham a beautiful pair of skulls obtained by him in Natal. Lieut. H. Trevelyan has also presented several specimens from Kingwilliamstown.

<sup>3</sup> This alteration in the spelling of the name is necessary to bring its pronunciation into conformity with that of the country on which it is based.

<sup>4</sup> 705 b of Gray's Hand-list Edent. &c. p. 42; not that figured pl. x. fig. 1, which is probably *P. capensis*.

form to Hemprich and Ehrenberg's *H. habessinicus* has been frequently questioned, and, as will be seen below in the remarks to that species (p. 66), I have come to the conclusion that it cannot be supported. The species therefore requires the new name given it by Giglioli, if it is considered to be distinct from *P. capensis*, to which it is most certainly allied. However, although its skull cannot be with certainty distinguished from that of the Cape animal, yet its longer softer fur, its more olivaceous colour, its much larger dorsal spot, and its great difference in locality induce me to consider it as requiring specific distinction.

The Genoa Museum possesses a large series of this handsome animal, obtained at many different localities in Shoa by Messrs. Antinori, Beccari, and Ragazzi, while there are in the British Museum the two typical specimens, besides several skulls, collected by Capt. Harris at Ankober. In addition I refer to this species the two specimens from the Dalanta plateau spoken of as "*Hyrax* sp. nov." by Mr. Blanford<sup>1</sup>, this locality being the most northern recorded for the present species, and yet considerably south of any place at which he obtained *H. abyssinica* (his *H. brucei*)<sup>2</sup>.

### 3. PROCAVIA SYRIACA.

*Hyrax syriacus*, Schreb. Säug. iv. pl. cxxl. B (1784), p. 923 (1792).

*Hyrax sinaiticus*<sup>3</sup>, Gray, Ann. Mag. N. H. (4) i. p. 45 (1868).

Size medium or rather small. Mammæ 1-2=6. Fur long, rather soft and shaggy, not so smooth as in the other species. General colour a sort of dull orange-yellow or fawn, not so sandy as *P. ruficeps*. Belly yellow or brownish yellow, but very variable in tone.

Dorsal spot large and clearly marked, yellow, the hairs yellow throughout, to their extreme tips and bases; the yellow paler basally and darker terminally.

Skull<sup>4</sup> broad and strongly made, rather narrower, however, in the S. Arabian subspecies. Interparietal sutures persistent. Diastema about 9 mm., very slightly longer in the southern specimens. Molar teeth variable in size.

Ribs 20 (in one young specimen and also in that figured by De Blainville).

*Hab.* Syria, Palestine, the Sinaitic Peninsula, and the whole of Arabia.

This species was first described by Bruce in 1790<sup>5</sup>, but as he confounded the Abyssinian and Palestine Hyraces, the name *syriaca*, based on his description, has been rejected by some authors on the ground that his "Ashkoko" is the Abyssinian species and not the Palestine one. It is, however, quite clear that his main description

<sup>1</sup> Zool. Abyss. p. 257.

<sup>2</sup> *L. c.* p. 252.

<sup>3</sup> See footnote <sup>1</sup> to *P. ruficeps*, p. 64.

<sup>4</sup> Good figures: De Blainville, Ostéogr. iii. *Hyrax*, pls. i. & ii.

<sup>5</sup> Bruce, Travels, v. p. 139.

was based on a specimen obtained by him on Mount Libanus, and the name *syriaca* given by Schreber is evidence as to what country he considered the home of the species. I am therefore glad to be able to retain the name by which the species has so long been known.

Thanks to the energy of Dr. A. S. G. Jayakar, of Muscat, I am enabled to announce a very considerable extension of the known range of this species, and at the same time of the genus, for he obtained an adult female with its young at Dofar, on the southern coast of Arabia, about halfway between Muscat and Aden, no Hyracoidea having been previously known in Southern Arabia at all.

Although agreeing in most of its characters with the typical *P. syriaca* of N. Arabia, this Dofar specimen differs so markedly in the size of its teeth, as also does a Central Arabian one kindly lent me by the authorities of the Berlin Museum<sup>1</sup>, that I feel compelled to consider the southern form as subspecifically distinct from the northern. I propose to name it in honour of its discoverer Dr. Jayakar, to whom the British Museum is indebted for examples of so many members of the Arabian Fauna.

Subspecific diagnoses :—

A. *P. syriaca typica*.

Size rather larger; skull broader; teeth markedly larger and heavier, very hypsodont; breadth of  $\overline{m}^1$  about 7·1 or 7·2 mm., height of crown of  $\overline{m}^3$  about 7·0. Horizontal length of  $\overline{p}^1$  about 2·2 mm.

*Hab.* The northern half of the whole range of the species.

B. *P. syriaca jayakari*, subsp. n.

Size rather smaller, and skull narrow; teeth smaller; breadth of  $\overline{m}^1$  6·2<sup>2</sup> mm.

*Hab.* South-eastern half of Arabia.—Dofar, S. Arabia (*Brit. Mus., Dr. Jayakar*). Melhan, Central Nejd (*Berlin Mus., Coll. Schweinfurth*).

Judging only from the type-specimen, this southern subspecies seems to have a rather darker coloration, and less ragged, shaggy hair, than the typical form, but of course one can lay no stress on these characters without further specimens for comparison.

#### 4. PROCAVIA RUFICEPS.

*Hyrax ruficeps*, Hempr. & Ehr. Symb. Phys. decas i. pl. ii. (upper figure) (1828).

<sup>1</sup> I must thank Prof. Möbius and Dr. Matschie for the loan of this skull, and also for one of the typical variety from Sinai. In spite of the time that it has been known, specimens of *P. syriaca* are by no means common, and the British Museum possesses only one stuffed specimen without a skull. However, besides the two Berlin skulls just mentioned, Canon H. B. Tristram has kindly lent me a skin and skull from Palestine, and there are two Syrian examples in the Genoa Museum collection, originally obtained by Dr. Lortet.

<sup>2</sup> 6·4 in the specimen from Melhan.

*Hyrax burtoni*, Gray, Ann. Mag. N. H. (4) i. p. 43 (1868); Cat. p. 285 (1869).

*Hyrax dongolanus*<sup>1</sup>, Blanf. P. Z. S. 1869, p. 642; Bocage, J. Sci. Lib. (2) iii. p. 192 (1889).

Size rather large; form elongated. Ears apparently more sharply pointed at the tip than in the other species. Mammæ 1-2=6. Fur long, but harsh and thin. General colour sandy fawn, grizzled with black, not so pale as in *P. pallida*, but paler than in *P. syriaca*.

Dorsal spot small and very little prominent amid the general sandy colour. Its hairs coloured very much as in well-marked specimens of *P. abyssinica*—i. e. brown at the bases, bright orange-yellow subterminally or terminally, with or without black tips.

Skull and teeth large and strong, not definitely distinguishable from those of *P. abyssinica*. Interparietal sutures persistent. Breadth of  $\underline{m}^1$  7.0 to 7.7 mm.; height of crown of  $\underline{m}^3$  6.9 mm.; horizontal length of  $\overline{p}^1$  2.5 or 2.6.

*Type* in the Berlin Museum.

*Hab.* Dongola (*Hemprich & Ehrenberg*); Egypt (*Burton*).

This species, to which I follow Mr. Blandford in assigning *Hyrax burtoni* of Gray, appears to be essentially a northern desert form of *P. abyssinica*, and leads on towards *P. syriaca* of the other side of the Red Sea. All these species are very closely allied to one another, their skulls being practically indistinguishable, and their distinctions resting mainly on colour. *P. ruficeps*, however, has decidedly more pointed ears than the others, at least so far as the three typical specimens of "*H. burtoni*" are concerned, but I do not know how far this is likely to be a constant character. It is unfortunate that the name *ruficeps* should stand for this species, as the rufous on the vertex is far less strongly marked than it is in many specimens both of *P. abyssinica* and *P. shoana*:

##### 5. PROCAVIA ABYSSINICA.

*Hyrax habessinicus*, Hempr. & Ehr. Symb. Phys. decas i. pl. ii. (the dark-coloured specimen) (1828).

*Hyrax abyssinicus*<sup>2</sup>, auctorum plurimorum; Blanf. P. Z. S. 1869, p. 642; Bocage, J. Sci. Lib. (2) iii. p. 122 (1889).

*Hyrax alpini*, Gray, Ann. Mag. N. H. (4) i. p. 45 (1868); Cat. p. 287 (1869).

*Hyrax ferrugineus*, Gray, Ann. Mag. N. H. (4) iii. p. 242 (1869); Cat. p. 288 (1869).

<sup>1</sup> The use of this name is due to a mistaken idea of Hemprich and Ehrenberg's meaning in first founding the species. Their work being written throughout in Latin, the simple statement of the locality of the animal "*Hyrax ruficeps (dongolanus)*" was taken for an alternative name, and then preferred to *ruficeps* as more appropriate. No doubt Gray's misquotation of "*Hyrax ruficeps vel dongolanus*" was the first cause of the mistake. The same remarks, *mutatis mutandis*, apply to the use of the word "*sinaiticus*" for *H. syriacus* by Gray.

<sup>2</sup> Now that "Abyssinia" and not "Habesh" is the form of the name invariably used, it seems better to adopt the amended spelling "*abyssinica*" rather than "*habessinica*." Mr. Blandford also comes to the same conclusion; vide his footnote, P. Z. S. 1869, p. 639.

*Hyrax irroratus*, var. *luteogaster*<sup>1</sup>, Gray, Ann. Mag. N. H. (4) iii. p. 242 (1869) (excl. description of dorsal spot)<sup>2</sup>; Cat. p. 288 (1869).

*Hyrax brucei*, Blanf. P. Z. S. 1869, p. 642; Zool. Abyss. p. 252 (1870); Bocage, J. Sci. Lisb. (2) iii. p. 193 (1889) (*nec* Gray).

Size medium, smaller in var. *minor*. Mammæ 1—2=6. Fur ordinarily fairly long, at least in the highland specimens, but always rather coarse and harsh, never long, soft, and fine, as in *P. shoana*; quite short and crisp in the subspecies from the Assab region. Colour a coarsely-mottled grey-brown, varying towards either olive or ferruginous; some specimens marked by rufous over the greater part of the back. The hairs dark brown at their bases, and black at their tips, with a broad subterminal band of dirty yellow.

Dorsal spot very small, oval, more inconspicuous than in any other species, often only to be found after the most minute search, below and between the ordinary hairs, and sometimes not at all. It consists simply of a broadening and brightening of the ordinary subterminal yellow band of the hairs, and when well developed is of a bright orange-yellow colour. In the great majority of specimens the black tips to its hairs so hide the yellow that the spot is not visible at all unless specially searched for.

Skull<sup>3</sup> stout and strongly built. Muzzle short. Coronal and parieto-interparietal sutures persistent<sup>4</sup>. Temporal fossæ extending backwards to within 3 or 4 mm. of the hinder edge of the skull. Diastema rather constant in its length, generally about 9 mm., but considerably less in var. *minor*. Teeth ordinarily very large and heavy in proportion to the size of the animal, the breadth of  $\underline{m}^1$  commonly being about 7·4 to 7·9, but in some specimens, which I cannot otherwise distinguish, they are much smaller and lighter, all the intermediate links being, however, present. The least breadth of  $\underline{m}^1$  among those before me is 6·7 in the type of "*H. irroratus*, var. *luteogaster*," but here the two teeth are considerably worn down, and probably the true breadth would have been somewhat greater. Height of crown of  $\underline{m}^3$  6·9 or 7 mm.  $\overline{P}^1$  very small, styliform, single-rooted, early deciduous; the horizontal length of its crown only about 2 or 2·2 mm. Ribs ordinarily 21 (but 20 in one specimen and 22 in another).

*Type* in the Berlin Museum.

*Hab.* Abyssinia from Bogos and Massowa in the north, through the highlands, as far south as Adigrat. Represented in the lowlands more to the east by the variety *minor*.

<sup>1</sup> Misprinted "*leucogaster*," Hand-l. Edent. &c. p. 42 (1873).

<sup>2</sup> See footnote, p. 70.

<sup>3</sup> Good figures: Gray, Hand-l. Edent. &c. pl. x. fig. 2 ("*brucei*"), pl. xi. fig. 1 ("*ferrugineus*"), pl. xii. fig. 3 ("*irrorata*"), 1873.

<sup>4</sup> In one specimen (B.M. 69. 10. 24. 37), an old male, the parieto-interparietal sutures are closed, but the suture down the centre of the interparietal bone itself still persists. The latter condition also obtains in 6 out of 18 very young skulls (stages I. and II.) of different species, but in no other specimen of adult age. Among the 12 very young skulls with the central suture closed is at least one taken from a fœtus.

Subspecific diagnoses :—

A. *P. abyssinica typica*.

Size larger. Fur longer. Colour as above described.

B. *P. abyssinica minor*, subsp. n.

Size smaller (see skull measurements in table). Fur short and crisp. Colour much as in the typical subspecies, but, owing to the shortness of the fur, there is an appearance of a greater general uniformity on the back.

Dorsal spot not more prominent than in var. *typica*, its hairs being equally tipped with black.

Skull small, with a comparatively very short diastema, almost rivalling that of *P. pallida*, 6.2 and 6.5 mm. in the two co-types. In neither specimen is  $\bar{p}^1$  present, so that the tooth is evidently dropped very early in the present form.

*Hab.* Alali, between Beilul and Assab, on the west shore of the Red Sea, about 13° N.

Two specimens of this peculiar little form were obtained from the above-mentioned locality by Dr. V. Ragazzi for the Genoa Museum. Both are somewhat immature, being at stage VI.

*P. abyssinica minor* is interesting, as leading on from the true *P. a. typica* towards *P. pallida*, found still further east in Somali. Both in size and in its shortened diastema it approaches that species, although in colour it shows no tendency to the greater paleness of the back and conspicuousness of the dorsal spot characteristic of *P. pallida*.

*P. abyssinica*, with its variations in colour and size, has always been and still is the most difficult form to work out of all the family, and I cannot at all hope to have satisfactorily settled the many problems which arise in the contemplation of any considerable series of specimens apparently belonging to it. In the first place, the original description was founded mainly on a specimen with a black dorsal spot, a character found in the Shoan species, but not ordinarily in the Abyssinian one, but with this specimen there was a second showing the typical black and yellow spot of the ordinary Abyssinian form. Now, as Mr. Blanford<sup>1</sup> states so directly that "the species identified by Gray with Ehrenberg's *H. abyssinicus*<sup>2</sup> is a very distinct form," and geographical considerations point so strongly in the same direction, I am induced to look upon Ehrenberg's black-backed specimen from Massowa as one of those troublesome individuals of the present species in which the yellow dorsal spot is practically absent, and the black tips to the hairs are so developed as to form a small dorsal black spot<sup>3</sup>. In any case I feel I cannot allocate this Massowa specimen<sup>4</sup> to the Shoan black-backed form

<sup>1</sup> Zool. Abyss. p. 251.

<sup>2</sup> *J. es.* the Shoan Coney.

<sup>3</sup> See, for instance, Mr. Blanford's specimen No. 886 (B.M. 69. 10. 24. 28).

<sup>4</sup> Dr. Matschie, of the Berlin Museum, however, is inclined to hold the opposite opinion, believing at the same time that the Massowa form is a small local race of the black-backed Shoan one. Should this view be correct, and I am



in the face of the fact that Mr. Blanford thoroughly hunted all the country between, specially looking out for Hyraces, without finding any trace of *P. shoana* until he penetrated as far south as the Wadela plateau, while the yellow-backed form was exceedingly common throughout the country from Massowa southwards. The skulls of the two forms unfortunately give no help in the matter, as they differ only in size; and although *P. shoana* ordinarily is far larger than what I consider as *P. abyssinica*, yet dwarfed individuals seem occasionally to occur, in which the skull is scarcely larger than in the latter species. Still, as a fact, the sizes of the skull and teeth of Ehrenberg's type specimens agree closely with those found in the ordinary Abyssinian form to which I refer them.

#### 6. PROCAVIA PALLIDA. (Plate III.)

*Procavia pallida*, Thos. Ann. Mus. Genov. (2) x. p. 908 (1891).

Size small, form stout and squat. Fur very short, close, and crisp. Colour pale sandy grey, the hairs chocolate-brown basally, with a broad cream-coloured subterminal ring and a black tip. Rump rather more rufescent.

Dorsal spot small, oval, pale creamy yellow, the peripheral hairs with a broader and the central ones with a narrower brown basal part, but none of them with darker tips.

Skull (Plate III.) short, broad, and stout, in general appearance a miniature of the large-toothed Abyssinian forms *P. abyssinica* and *ruficeps*; coronal and interparietal sutures persistent. Molars very large in proportion to the size of the animal, and in consequence of this the diastema is shorter than in any other known species, being only 5.6 mm. between the alveoli, and 5 between the teeth above, while in the lower jaw it is practically non-existent,  $\bar{p}^2$  almost touching the outer incisor basally and only distant from it about 1 mm. terminally. It therefore leaves no room for  $\bar{p}^1$ , occasionally present in other species.  $\bar{M}^1$  6.9 mm. broad in the type;  $\bar{m}^3$  with a high crown, but, as it is somewhat worn, I can only say that it is more than 5.4 mm. high, that being its present height.  $\bar{P}^1$  gone in the type; no doubt small and early deciduous.

*Hab.* N. Somali-land.

*Type* in British Museum (85. 11. 16. 4).

This peculiar little species bears, within the typical *Procavia* with open interparietal sutures and large teeth, very much the same relation to *P. abyssinica* that *P. brucei somalica* does in the "*Heterohyrax*" group to *P. b. typica*, the geographical relations of each pair

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by no means positive about the opinion advocated in the text, the name of the Massowa Hyrax would be *P. abyssinica typica*, of the Shoan one *P. abyssinica shoana*, and of the ordinary N. Abyssinian one with yellow dorsal spot *P. alpini*, Gray. In this connection I must again express my sincere thanks to Dr. Matschie for the patience and kindness with which he has borne the brunt of question after question about this unfortunate type of Hemprich and Ehrenberg's, a specimen which, in spite of all, must still remain a stumbling-block for naturalists until it is supplemented by a proper series of fresh examples collected exactly at the same place.

being just the same. Its differentiation has, however, proceeded so much further that I have had little hesitation in erecting it into a distinct species, even though *P. abyssinica minor* approaches it in some respects. The type is a fully adult female obtained on the 25th of December, 1884, by the well-known collector Herr J. Menges, on the Hekebo plateau, N. Somali-land.

It is much to be hoped that further specimens of this little species will be soon obtained, so that we may gain an idea of its variation and geographical distribution.

#### 7. *PROCAVIA WELWITSCHII*.

*Hyrax arboreus*, Peters, P. Z. S. 1865, p. 401 (*nec* Smith).

*Hyrax welwitschii*, Gray, Ann. Mag. N. H. (4) i. p. 43 (1868); Cat. p. 236 (1869); Bocage, J. Sci. Lisb. (2) iii. p. 186 (1889).

Size medium. Mammæ 1—2=6. Fur short, very coarse and hispid, quite unlike that of any other species. General colour of back coarsely grizzled sandy brown, the hairs dark blackish brown for five-sixths of their length, dull yellow terminally or subterminally, the tips, however, more rufous on the face and along the centre of the back; the brown bases of the hairs showing through and materially darkening the general colour.

Dorsal spot, in the single specimen available, rather elongate, although not so much so as in *P. brucei* and its allies. Its hairs dull yellow throughout.

Skull<sup>1</sup> stout and strong; muzzle short; frontal region unusually broad, the ledges overhanging the orbits, more developed than in other species; interparietal sutures persistent; diastema short, about 8 mm. in each of the two specimens before me; temporal fossæ extending backwards quite to the occipital ridges. Teeth rather small, breadth of  $m^1$  6·4 and 6·5 in two skulls; height of crown of  $m^3$  5·2;  $\bar{p}^1$  elongated, two-rooted, more as in the *Heterohyrax* and *Dendrohyrax* groups, its crown 4·1 mm. long horizontally.

*Hab.* Angola, coast-region (*Bocage*).

The only specimens of this rare species that I have been able to examine are the skull of Dr. Welwitsch's original type, most kindly lent me by Prof. B. du Bocage, and a skin with its skull received in 1888 by the British Museum from the Lisbon Museum. Both these specimens have been examined and the typical skull figured by Prof. Bocage, so that I have no material by which to supplement the excellent description he has there given to the species.

The true position of *P. welwitschii* in the genus is somewhat doubtful, as its skull agrees best with those of *P. syriaca*, *abyssinica*, &c., its elongated dorsal spot and rather small teeth but long  $\bar{p}^1$  approach those of *P. brucei* and *bocagei*, while the peculiar quality of its fur separates it from any other species.

Dealing only with the Angolan species, Prof. Bocage has taken it as a type of the *Procavia* group; but I consider that if anything it is further from *P. capensis* and *abyssinica* than it is from *P. brucei* and

<sup>1</sup> Good figure: Bocage, *t. c.* pl. i. fig. 1.

*bocagei*. More specimens, however, to show its variability and geographical distribution will be needed before its true relationship can be cleared up.

#### 8. *PROCAVIA LATASTEI*, sp. n.

Fur close, soft and fine. General colour soft fawn-grey, more pallid than in *P. brucei*. A large patch on the side of the neck pale yellowish white, the hairs pale at their bases; this patch is not, however, conspicuous amid the general pallor.

Dorsal spot narrow, elongate, clear pale yellow to the bases of the hairs; in fact, just as in *P. brucei* and *bocagei*.

Skull in general form much as in *P. brucei*, except that it appears to be rather broader and more stoutly made. Muzzle short and conical. Interparietal and coronal sutures persistent. Diastema long, 10 to 12 mm. Teeth small, but proportionally rather larger than in *P. brucei*. Breadth of  $m^1$  6 to 6.5 mm.  $\bar{p}^1$  small, but two-rooted, 3 or 3.1 long.

*Co-types* nos. 55-3238 (skin) and 2684 (skull) of the Genoa Museum (*coll. Lataste*).

*Hab.* Senegal.

M. Lataste obtained several specimens at Félou and Medine, Upper Senegal, and there is a young one in the British Museum received in 1844 from the dealer Parzudaki, and referred to "*H. burtoni*" by Gray (Cat. Carn. &c. p. 285).

From M. Lataste's notes and drawings I gather that he referred his Senegal specimens to *P. bocagei*, a reference by no means very wrong, as they are unquestionably closely allied to that form. I am, however, induced to separate them, at least for the present, by the fact that the whole of his specimens, 7 in number, besides an eighth, fully adult, of which he gives a drawing, have their interparietal sutures persistent, thus differing from *P. bocagei*, in which the sutures are all closed by about stage IV. or V.

The close alliance of this species to "*Heterohyrax*" *brucei* in general characters, while it has the open sutures of *Procavia s.s.*, is a striking proof of the necessity for abolishing *Heterohyrax* as a separate genus.

It is with great pleasure that I attach to this species the name of the distinguished author of the paper "Sur le système dentaire du genre Daman"<sup>1</sup>, who collected the specimens himself, and after whom it is particularly suitable that a member of this interesting genus should be named.

#### 9. *PROCAVIA BOCAGEI*.

*Hyrax bocagei*, Gray, Ann. Mag. N. H. (4) iii. p. 242 (1869); Cat. p. 289 (1869).

*Heterohyrax bocagei*, Bocage, J. Sci. Lisb. (2) iii. p. 188 (1889) (general description, habits, &c.).

Size rather small. Fur soft and close. General colour soft

<sup>1</sup> Ann. Mus. Genov. (2) iv. p. 5 (1886).

grizzled grey, very much as in *P. brucei*. Posterior back not tinged with rufous. Belly white or yellowish.

Dorsal spot inconspicuous, nearly hidden by the surrounding hairs, but on separating these it is seen to be well-developed, elongate, its hairs white or pale yellow to their bases.

Skull<sup>1</sup> light and slender, with a narrow elongated muzzle and flattened frontal region. Parietal, interparietal, and coronal sutures closing at about stage V., always closed in adult animals. Diastema long, about 13 mm. in adults.

Teeth small and delicate, markedly brachyodont; breadth of  $m^1$  5.6 to 6.4; height of crown of  $m^3$  about 4.5.  $\overline{p}^1$  elongate, two-rooted, long, persistent, its crown about 3.7 or 3.9 mm. long.

*Type* in British Museum (68. 12. 19. 3).

*Hab.* Angola ("région moyenne, et les hauts plateaux," *Bocage*).

The retention of this species as distinct from *P. brucei* rests on very much the same, rather slender, foundation that the separation from it of *P. latastei* does, namely the age at which the interparietal sutures ordinarily close. This seems to take place in *P. brucei* at about stage II., in *P. bocagei* at stage V., and in *P. latastei* never, or at least not until fully adult life is reached. The longer and slenderer muzzle of *P. bocagei* and its more developed  $\overline{p}^1$  may also serve to distinguish it from both, which then, the intermediate link being gone, seem more than ever distinct by their interparietal characters.

#### 10. PROCAVIA BRUCEI.

*Hyrax brucei*, Gray, Ann. Mag. N. H. (4) i. p. 44 (1868); Cat. p. 287 (1869) (excl. syn.—not of later authors<sup>2</sup>).

*Dendrohyrax blainvillei*, Gray, Ann. Mag. N. H. (4) i. p. 50 (1868); Cat. p. 293 (1869).

*Hyrax irroratus*, Gray, Ann. Mag. N. H. (4) iii. p. 242 (1869) (excl. description of dorsal spot<sup>3</sup>); Cat. p. 283 (1869).

*Hyrax mossambicus*, Peters, SB. nat. Fr., 1869, p. 25.

*Dendrohyrax bakeri*, Gray, Ann. Mag. N. H. (4) xiv. p. 132 (1874).

Size small; forms slender. Mammæ 1—2 = 6. Fur short and close, but fine and generally soft. Colour clear grey, finely grizzled with white; underfur pale silvery fawn, rather darker basally. Posterior back generally quite similar to the rest, very rarely more rufous, and then only just above the anal region.

Dorsal spot narrow, elongated, white or yellow, the hairs often white at base and becoming more fulvous terminally, but never with any admixture of brown.

<sup>1</sup> Good figures: Gray, Hand-l. Edent. &c. pl. xi. fig. 2 (1873); Bocage, *t. c.* pl. i.

<sup>2</sup> Nor of the same author's Hand-l. Edent. &c. p. 40 (1873), where the great majority of the specimens mentioned, and the figured skull, belong to *P. abyssinica*.

<sup>3</sup> By some curious error the descriptions of the dorsal spots of "*H. irroratus*" and "*H. ferrugineus*" were interchanged in Gray's original paper, but the error was corrected in the "Catalogue" published shortly afterwards.